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IMPROVED FILTERS.

In our issue of January 7, 1882, we gave an illustrated description of the "Multifold Filter," manufactured by the Newark Filtering Company. That filter was composed of several superposed compartments, the sand in which was washed by means of traveling jets of water.

The plan of washing is the invention of Mr. P. Clark, of Rahway, N. J., while the multifold construction of the filter was invented by Mr. J. W. Hyatt, of Newark. The multifold jet washer filter was a very excellent filtering device, and very likely no change in the system of filtering would have been adopted by this company had it not been for the inventive activity of Mr. J. W. Hyatt, the president of the company. The results of his invention in this direction are seen in three styles of filters here illustrated, and which are styled the Hyatt filters.

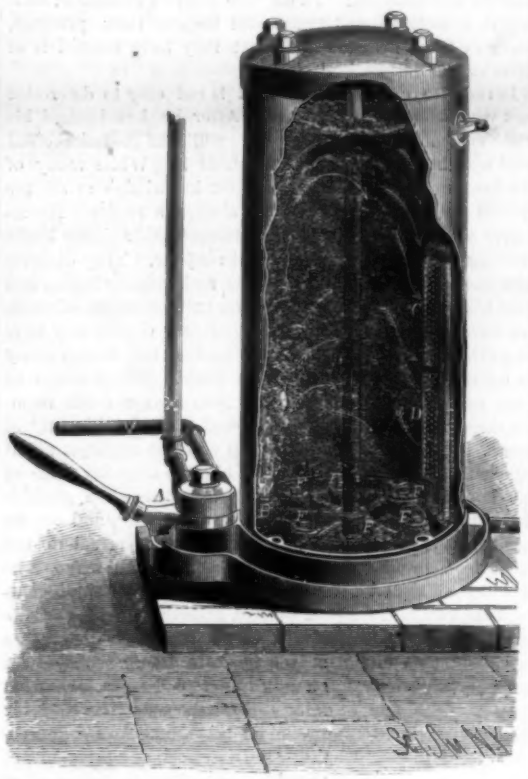
In these machines the movement of the water through the filter and the means of removing the impurities arrested by the filtering medium are striking and novel.

While these filters are adapted to the use of animal charcoal, wood charcoal, and various other filtering materials, there are very few cases where anything like the quantity and quality of water can be filtered by these substances so efficiently and economically as by the use of suitable sand. Where sand can always be kept clean and without waste, as can be done in the Hyatt filters, it is the most effective and at the same time least expensive of all filtering substances for purifying large quantities of water.

The economy of sand for filtering is shown, for instance, by the fact that the sand in a filter containing 50 bushels costs but a mere trifle, while 50 bushels of animal charcoal would cost about $150. The sand will last for many years without deterioration, while the charcoal, which while fresh, is excellent for decolorizing water, will become unfit for use in two or three months.

We shall therefore speak in this article of sand as the filtering agent employed.

The Hyatt filter No. 1 is especially adapted to houses, small steam boilers, laundries, etc., and wherever the quantity of water to be filtered is supplied through a ¾ inch pipe under a pressure of five or six atmo pheres, or less. Its operation is as follows: The water is admitted by the compound cock, A, and passes through the valve, B, into the sand. The course of the water, during the operation of filtering, is indicated by the arrows shown in the cut. A portion of the water passes upward from the valve, B, entirely through the sand by the side of the filter to the top, and then descends to the discharge pipes. Other portions traverse the sand from the side at various heights, between the top and bottom, and all escaping through the perforated discharge tubes, C, D. The upward current of water entering from the valve, B, loosens up the sand and keeps it in a state of mild ebullition for a distance laterally something less than one-fourth of the diameter of the filter. The sand is loosened the most and has the greatest motion next to the side of the filter, while further away it gradually moves slower, and becomes closer as the distance increases from the side, until motion ceases, and the sand compacts together more and more by the pressure of the water passing through. By this plan, in the first part of the filtering operation, the coarsest impurities in the water are retained in a distributed condition by the portion of sand which is in a loosely moving state; the next finer impurities are arrested a little further away, where, the current of water being slower, the sand is not so much disturbed; finer particles again are stopped further away by the still denser sand; and so the process goes on by gradations, till the water comes into sand which is motionless and compact. In this compact sand, adjacent to the outlet, the fine and last remaining impurities are obstructed, and pure water passes through the tubes, C, D, into the outlet pipe, E.

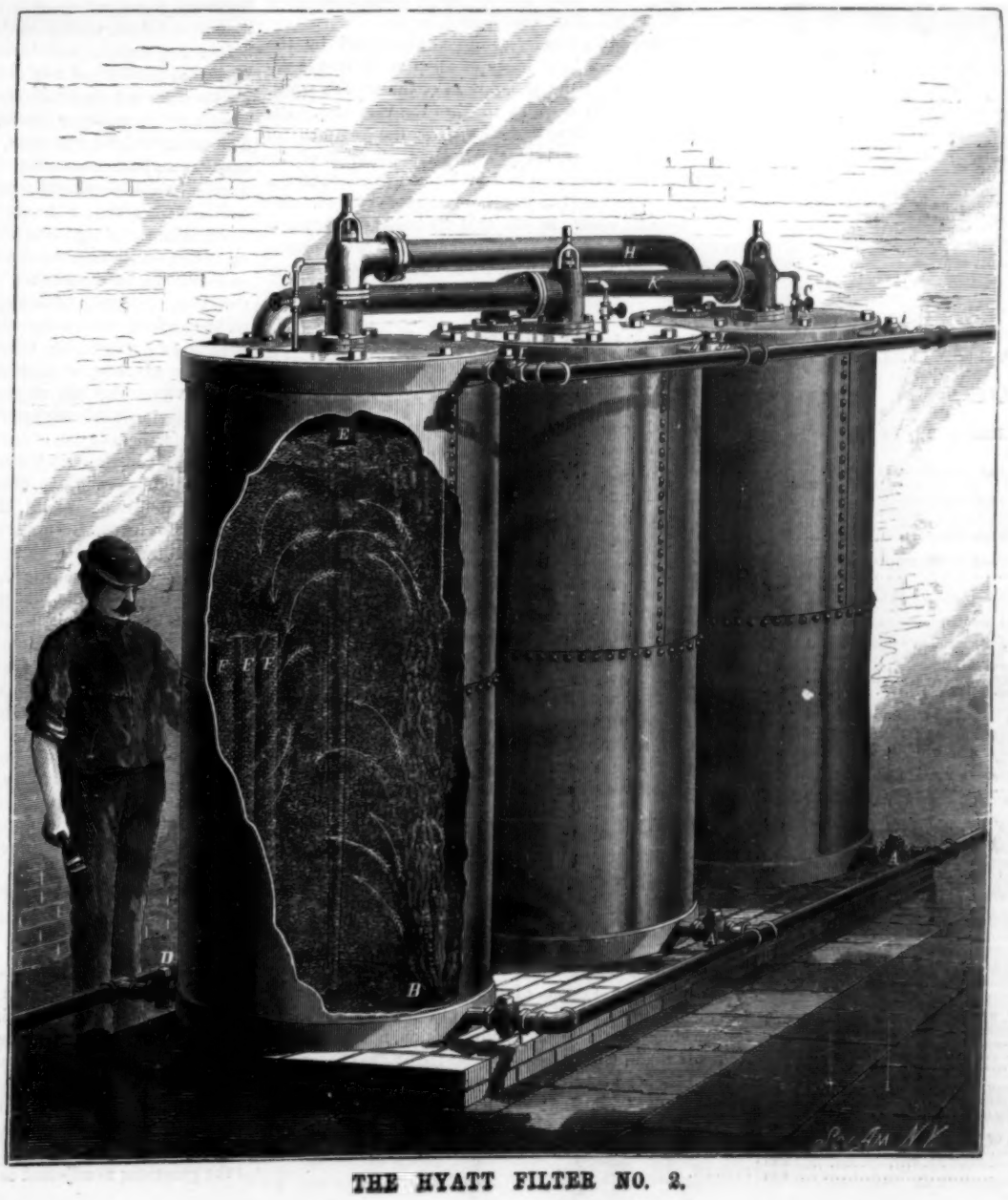


THE HYATT FILTER NO. 1.

This description applies to each of the three varieties of Hyatt filters here shown. It permits a larger amount of water to be filtered by a given quantity of sand than is possible where the silt and impurities are permitted to accumulate in a dense stratum upon the motionless surface of a filter bed. At the same time the sand is in condition to be more easily cleansed, the impurities being loosely distributed among the particles of sand instead of adhering together in a more or less tenacious mass.

The filtering process having thus been explained, the method of cleansing the sand from the accumulated impurities will be described. As a rule the sand in a filter should be thoroughly washed at least once a day, although this depends upon the character and amount of impurities which the water contains. In warm weather, especially, cleansing should be done frequently to prevent decomposition of the organic matter remaining in the sand, which makes filters which are only cleansed at long intervals fountains of filth instead of purity.

In washing Hyatt filter No. 1, the handle of the compound cock, A, is turned to the left as far as it will go. This shuts off the water from the valve, B, and permits it to enter through the small valves, F, which are distributed at regular intervals in the bottom of the filter bed. From these valves the water rushes upward through the sand, loosening and carrying with it all of the silt and impurities that have been retained in the sand while filtering, and discharging them through the central pipe, G, from which it issues by one of the openings in the compound cock, A, into the waste pipe, V. Five or ten minutes for washing is usually quite sufficient; and if this be done regularly each day, the filter will be kept in the most perfect order and will do its work for a practically indefinite period, as there is no waste of sand, and the filter is constructed of bituminized iron and has no working parts liable to get out of order. After washing, the handle is turned to the right until it stops, and filtering is at once resumed.



THE HYATT FILTER NO. 2.

Some of these filters are arranged for the introduction of the unfiltered water over the sand instead of at the bottom. It is then filtered downward and discharged through perforated metal below. In a filter of the form and capacity of house filter No. 1, this arrangement will give finer filtration but a less quantity of water. The plan of washing the sand is, however, as above described.

Hyatt filter No. 2 is made in diameters of 40, 50, 96, and 120 inches respectively. They are worked in gangs or series of from two to ten in number, as may be desired. The method of filtering is the same as has been described in No. 1, the water passing up from the inlet valve, B, and passing across to the outlet screens. By reference to the arrows shown in the cuts and to the description of filter No. 1, this method of filtration will be

(*Continued on page 195.*)

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 378,

For the Week ending March 31, 1883.

Price 10 cents. For sale by all newsdealers.

EDUCATION FOR MECHANICS.

The question of the extent of the benefits of education to the working mechanic is an old one. Many place too high a value upon the utility of learning. To them knowledge seems all powerful; it is a key that unlocks every door. It is among those of lesser culture that this opinion mostly obtains. They overestimate the value of science, while the better educated fall into the opposite error, and undervalue it. As usual, the truth is to be found in the middle. Education of whatever nature exerts a certain influence upon all our actions, but is not responsible for everything. Those who are wanting in it are apt to attribute all their troubles to this deficiency. How often does some inefficient mechanic say that he would have done much better if he had only been educated. He cannot see that his faults are positive and inherent. Those who possess education, finding that their natural faults still impede their progress, come to the conclusion that what they have learned is of little value.

In the case of the mechanic it is not easy to determine just what knowledge is worth. After he has learned his trade mechanically, it is worth his while to go further and read up what has been written about it. While many of the best workmen do not use book knowledge at all, the typical intelligent workman is always a reader. He receives a scientific journal and possesses half a dozen books treating of lathe work and kindred subjects. They describe case hardening compounds, brazing and welding fluxes, and give hints on lathe management, on cutting angles of tools for different metals, and the like. Every day he may have to go through some of the operations they tell of, yet rarely or never will he leave the beaten track. But although he may not follow them in practice, he always reads them. He does good work in the shop, and reads intelligently at home. If any question comes up with his employer about mechanical points, he will bring him the next day some of his books or papers as authorities, yet his shop work is done on principles learned by hard experience, and not by book theory. His books and his scientific journal do not seem to help him there. Clever as the man may be, he would seem at first sight to lack the faculty of applying his book knowledge. Yet if we go a little deeper into the subject, it may appear that it is because of his excellence as a mechanic that he rejects the book in practice. The hard school of experience has taught him two lessons. One has been a right way of doing things; the other has been the danger of trying to improve on that way. In the apprenticeship of the mechanical arts the work of generations of mechanics is imparted to the learner. The evolution of so many minds and years should be treated with reverence. To institute a genuine and valuable improvement is far from easy.

All this proves the dignity of the position held by the mechanic. He has a knowledge of shop work that is derived, as just stated, from generations of the world's work. His knowledge of this work is, then, of the very best. His acquaintance with different metals, with the treatment of different steels and irons, is perfect. His application of it is an instinct. He will seldom find in his course of reading a justification for leaving the way he is accustomed to. His special branch he knows so well that the books can scarcely improve it. His thorough knowledge of shop work attains to the dignity of a liberal education. It is not to be despised or looked down on because not acquired under the roof of a college.

This is a fair picture of the good mechanic as found in our shops to-day. He reads, but does not often succeed in applying his reading. Yet he will study, and will enjoy studying. It elevates his mind by giving it something besides itself to live upon. Seldom as the direct application of his reading comes into his work, its indirect influence affects every blow of his hammer. His intellectual being is improved by it, and his self-respect increased. His journal and books give it good pabulum. The benefits of education cannot be doubted in his case.

ANALYSIS OF WATER.

Chemistry will unfailingly reveal the elements and their proportions in a compound, and also the inorganic quantities; yet it will be at a loss to show the organic components more than approximately. Tests will only show the presence, not the exact parts, of the latter, and as the process by evaporation and heating the residuum separates the volatile constituents of animalcules and vegetable compounds, their amount cannot be determined with certainty.

It is only after disease germs have been traced to water as their medium of diffusion that the water is subjected to examination. The microscope failing to show them, their existence can only be proved by placing them in conditions favorable to their development. Inorganic ingredients of a hurtful nature can be ascertained, and the proportions which it would be dangerous to health to exceed are known. Vegetable matter can be closely calculated, but the results that would ensue by changes under certain conditions can only be obtained by a system of *a priori* reasoning. But the germs, the most insidious enemy to health in water, as neither atmospheric nor mechanical action, nor dilution, will eradicate them, cannot be found.

The benefits accruing from the solution of this problem cannot be overestimated; physicists are bending their energies in this direction, and students are entering the field; it is a wide one, and one that, if explored, will yield boundless reward.

SITES FOR WATER SUPPLIES.

The transition from a village to a city is so rapid in this country as to seem to be due to the agency of the "magic lamp," and yet all the privileges and conveniences enjoyed by the old are demanded by the new communities. Undoubtedly among the most important of these, and one to which attention is forcibly drawn as spring opens and building operations are resumed, is that of a perfect supply of water.

In selecting a locality whence to obtain this supply, it would be judicious to insist upon certain conditions which are vital to success. Absolute purity of the source should be the first characteristic. The entire watershed should be carefully examined, and everything avoided that would even be liable to produce corruption. In the case of wells, chemical analysis will take the place of inspection. After having obtained a source now pure, the possibilities of contaminations in the future should be looked to. It is a well known and frequently demonstrated law that security breeds negligence, and in the case of water supplies this is often tested. Imperceptibly the water will become unwholesome, and yet its true character will remained concealed until disease is traced to it, when an examination reveals impurities which have crept in and been steadily increasing.

For many reasons the quantity of the supply should be sufficient, not only for present needs, but to allow for growth and increased consumption. After these comes the next factor, one that is, unhappily, often ranked as first—that of cost. The works should be built economically, but when poor work is liable to risk the whole, the economy is false. Due attention should be paid to so constructing the first system that it could, when the time came, be increased by the expenditure of a moderate percentage of the first cost.

The Great Statue of Liberty.

A singular problem in engineering is presented to the committee which has in charge the construction of the pedestal for the great statue of Liberty in New York harbor. About eighty thousand dollars out of the necessary two hundren and fifty thousand have been raised, but nothing has been done about the work. It is probable that operations would be begun at once with the funds in hand, if it were not that no plans have been made, and no architect or engineer has been engaged to make them, the committee not having been able to find any member of these professions willing to contribute them for nothing, or rather for the "great credit" which, "if properly done," they will "reflect upon the designer and engineer."

As the value of the drawings and superintendence for the pedestal alone, to say nothing of the responsibility of seeing the statue placed safely upon it, would be about twenty-five thousand dollars, we fear that the committee will look long before they find the individuals whom they seek. The task itself, independent of any consideration of proper payment for the time and responsibility involved, is not one that the most skillful engineer would wish to undertake hastily. The statue weighs, complete, only about eighty tons, but presents an immense surface to the wind, and stands, moreover, on a comparatively small base.

Considering that it is not extremely easy to construct a brick chimney of the same height—one hundred and forty-eight feet—weighing ten times as much, of pyramidal form, and standing on the ground, so as to resist the force of a storm, the difficulty of raising and securing the statue, not on the ground, but on the top of a pedestal nearly one hundred and fifty feet high, is apparent. There are no precedents for anything of the kind, and it will hardly do to secure the figure by the rope stays, like those of a derrick, which the incapable engineer would naturally resort to.

The members of the committee seem themselves to have perceived something of the difficulty of the undertaking, and have telegraphed to France for instructions as to the mode of doing the work. We do not generally volunteer advice, but it seems to us that the plan said to be employed by the Japanese for securing their light pagoda towers against the effects of wind, by means of a long weight or pendulum, hung from the top of the tower, and reaching nearly to the floor, might perhaps be employed with good effect for the New York statue.

A very similar device, applied by Sir Christopher Wren, has for two hundred years held up the spire of Salisbury Cathedral, as well as those of one or two other English churches, in which a heavy wooden framework, extending as far downward as the construction of the tower permits, is suspended by strong iron bars from the capstone, free to swing in any direction. The effort of the wind on one side of the spire inclines it until the hanging framework rests against the opposite side, but when the pressure is relieved, the pendulum swings back, bringing the stonework with it into its original place.—*Amer. Architect.*

Electric Tramway.

According to Mr. Trail, the engineer of the Giant's Causeway and Portrush Electric Tramway, the total prime cost will be about £31,000 for six and a half miles of tramway, the cost of buildings, rolling stock, electric plant, engines, law, parliamentary, and engineering expenses. He says also that the electric car is able to ascend a long, continuous hill of about one and a half miles in length, and with a gradient of 1 in 35, drawing a second car behind it, and work as readily and as well at a distance of two miles from the generator as adjacent to it.

ASPECTS OF THE PLANETS FOR APRIL.

VENUS

is morning star, and takes the lead of the planets that sing and shine while they anticipate the rising of the great luminary that will eclipse their lesser light. She is still traveling on the eastward track that brings her nearer to the sun, as she fulfills her course from western elongation to superior conjunction. Though her fair face is becoming "fine by degrees and beautifully less," she continues to grace the breaking of the dawn, and wins the admiration of every observer who watches her progress "under the opening eyelids of the morn."

Venus varies her course with an incident on the 10th. She is in conjunction with Lambda Aquarii, a star of the fourth magnitude in Aquarius, being twenty-six minutes south of the star. The nearest approach is at eleven o'clock in the morning. But planet and star will be near enough before sunrise to form an interesting picture. Venus will be far enough above the horizon for favorable observation soon after four o'clock, and will then be seen west of the star and approaching it. On the morning of the 11th, it will be seen that planet and star have passed each other, Venus being east of the star. Observers will note the rapid progress of Venus northward. At the end of the month she will be in northern declination, nearly twelve degrees farther north than at the beginning of the month.

The right ascension of Venus is now 22 h. 10 m., her declination is 11° 37′ south, and her diameter is 16·8″.

Venus rises on the 1st eight minutes after four o'clock in the morning; on the 30th she rises at thirty-eight minutes after three o'clock.

MARS

is morning star, but is too near the sun and too insignificant in size to be of much account. A better time is coming, and, before many months have passed, he will become an object of prominent interest as he approaches opposition. Like Venus, he is moving rapidly northward. At the close of the month he will be in northern declination, having traveled nine degrees north during the month. The farther north the planets are in this latitude, the more favorably they are situated for observation, and the longer is the circuit they make above the horizon.

The right ascension of Mars is 23 h. 6 m., his declination is 6° 57′ south, and his diameter is 4·3″.

Mars rises on the 1st at ten minutes before five o'clock in the morning; on the 30th he rises a quarter before four o'clock.

MERCURY

is morning star until the 16th, and evening star for the rest of the month. On the 16th, at six o'clock in the morning, he is in superior conjunction with the sun, passing behind the great luminary, and appearing on his eastern side to play his short role of evening star.

He is an active member of the solar community. On the 27th, rushing eastward, at full tilt, with a seeming intention to get as far away from the sun as possible, he encounters Neptune, plodding westward with tortoise pace, making every effort in his power to approach the sun as near as possible, the former moving with a velocity of nearly thirty miles a second; the latter moving with a velocity of three miles and a half in a second. They have a conjunction at the respectful distance of 3° 7′, and are hidden from terrestrial gazers by their near proximity to the sun. They, however, win distinction, for the meeting of the planet that travels nearest to the sun and the one that travels on the system's remotest bounds is the sole planetary conjunction on the meager annals of the month. Mercury is speeding north faster than either Venus or Mars, for during the month his northern declination increases twenty-three degrees.

The right ascension of Mercury is 23 h. 59 m.; his declination is 2° 33′ south, and his diameter is 5·6″.

Mercury rises on the 1st at twenty-one minutes past five o'clock in the morning; on the 30th he sets at twelve minutes past eight o'clock in the evening.

NEPTUNE

is evening star, and leads the quartett of giant planets in the time of rising and setting. He is now so far from the earth, and so near the sun, that large telescopes find it difficult to pick him up, but his course among the stars is as accurately mapped out as if he were visible to the unaided eye. His conjunction with Mercury has already been referred to.

The right ascension of Neptune is 3 h., his declination is 15° 19′ north, and his place is in Taurus.

Neptune sets on the 1st at a quarter after nine o'clock in the evening; on the 30th he sets at half-past seven o'clock.

SATURN

is evening star, and shines in the western sky for about three hours after sunset, when his pale disk dips below the horizon. He is now nearly south of the Pleiades, and presents no features of special interest to the ordinary observer. Even the telescopist will have to take a season of rest, for he is approaching the sun so closely that he will soon be hidden from view. Hidden, but not lost, for next autumn at opposition he will be more magnificent than he was during the past autumn and winter.

The right ascension of Saturn is 3 h. 26 m.; his declination is 16° 49′ north; his diameter is 16″, and he may be found in the constellation Taurus.

Saturn sets on the 1st about a quarter before 10 o'clock in the evening; on the 30th he sets at twelve minutes past 8 o'clock.

JUPITER

is evening star, the third in the order of rising, but he holds the palm among the planets and the myriad stars as the most brilliantly beautiful of the shining host. He distinguishes himself by no noteworthy deeds, but pursues the even tenor of his way with majestic mien, accepting with royal grace the honors due to his position as the giant member of the system, the finest exemplification of nature's fashioning hand

The right ascension of Jupiter is 5 h. 36 m.; his declination is 23° 15′ north; his diameter is 35·2″; and his place is in Taurus.

Jupiter sets on the 1st at twenty-five minutes past 12 o'clock in the morning; he sets on the 30th a few minutes before 11 o'clock in the evening.

URANUS

is evening star, and may still be seen by the unaided eye as a faint star in clear weather on moonless nights. His position varies little from that pointed out for March, being half a degree farther north. He is in Virgo, a little northwest of Beta Virginis, and may be best observed in the east about 8 o'clock.

The right ascension of Uranus is 11 h. 26 m.; his declination is 4° 31′ north; and his diameter is 3·8″.

Uranus sets on the 1st at 5 o'clock in the morning; he sets on the 30th at five minutes past 3 o'clock.

THE MOON.

The April moon fulls on the 22d, at forty-three minutes past 6 o'clock in the morning. The old moon is in conjunction with Venus on the 4th, Mars on the 5th, and Mercury on the 6th. The new moon of the 7th is near Neptune and Saturn on the 9th. The conjunction with Saturn will be the most interesting phenomenon of the month, the two days' old crescent passing forty-one minutes north of the planet, and the time of nearest approach being about a quarter after 8 o'clock in the evening. The conjunction is much closer than that of the 13th of February, when the moon and Saturn, imprisoned in the halo surrounding her, formed a charming celestial picture. On the 13th the moon is in conjunction with Jupiter, and on the 18th completes the planetary circuit by drawing near to Uranus. On the 22d the moon is eclipsed. The eclipse is invisible in this portion of the world, but may be seen on the Pacific coast, the Pacific Ocean, and Asia. Observers here will not lose much, for less than one-tenth of the moon's diameter will be eclipsed. The moon occults Beta Capricorni, a star of the third magnitude, on the 1st at seven minutes after 6 o'clock in the morning, the star being hidden for twenty-two minutes. The occultation takes place soon after sunrise, and is invisible, but the near approach of moon and star will afford material for interesting study.

SOME ANSWERS TO CORRESPONDENTS.

E. H. P.—"Luminous paint" is used to illuminate the faces of clocks and watches. It is a compound of lime and sulphur in varnish.—R. H.—There is no difference, in result, between one square foot and one foot square. One square foot may be contained in a figure of any desired shape containing 144 square inches; for example, a parallelogram 24 inches long and six inches wide; while one foot square is understood to represent a figure measuring 12 inches on each of its sides.—O. R.—The top of a locomotive wheel does not go around its axle, when running, any faster than the bottom of the wheel.—S.—Will take no more pickets to fence the hill than to carry the fence on the straight line shown in your diagram.—H. B. L.—The cannon ball fired from the rear of a train moving sixty miles an hour will pass the mile post.—J. A. M.—The profession of civil engineering offers inducements for young men to study. There are good colleges and many good books relating to engineering.—O. R.—You cannot run an electric light without considerable expense for machinery or for batteries.—W. D. T. Ordinary nut coal is the best for the purpose.—G. R. B.—Butter can be made from fresh milk by means of an ordinary churn.—J. L. B.—Railway ties made of paper pulp have been proposed.—H. S.—The best method of preserving and transporting fresh fruit is by means of the refrigerator cars. Splendid fruit is thus brought from California to the New York market.—F. E. S.—Solid iron columns are stronger than hollow iron columns of the same diameter; but the same weight of metal that is contained in the solid column, if it were put into the form of a hollow column, would be much stronger than the solid column.—J. W. P.—Better write to the Secretary of the Interior.—C. R.—There are various forms of sheep shears made with guards to prevent injury to the sheep.—C. L. F.—One way to make electrical belts is to sew a strip of copper and a strip of zinc inside of the cloth in such a manner that the zinc and copper will both be in contact with the surface of the skin. An amateur can produce good pictures with a portable photographic apparatus, such as you speak of.—There is no simple photo-engraving process, such as you call for.—F. S. M.—There is no especial place where you can go to study inventing. As for mechanical electricity, the best way will be to attend some polytechnic school.—S. R.—You can buy rubber cement at the drug stores.—C. T.—The nineteenth century closes December 31, 1899, and the twentieth century commences January 1, 1900.—E. C. B.—There is no way to prevent the lead from coming off.—F. C. K.—Powder exploded on the top of a rock under water will break up the rock; but a more economical mode is to drill the rock with the ordinary submarine drills, and then blast it in the usual way.—E. C. S.—You will find descriptions of cork machinery in the back numbers of the SCIENTIFIC AMERICAN.—J. A. R.—The cost to erect an electrical telephone for three miles, instruments, poles, wires, and all included, would be about $150 per mile.—A. C. L.—Dentiphones, or audiphones, are made in this country.—H. S.—See SUPPLEMENT, 357, electrical balance for showing presence of metals under surface of the ground. There is no other instrument for indicating the existence of precious metals.—E. L. R.—The Edson automatic steam recorder will tell you whether your fireman does his duty at night.—A. L.—For drawings of a timber drying apparatus see recent number of SCIENTIFIC AMERICAN SUPPLEMENT.—G. M.—Various forms of nut locks are in use.—T. A. M.—You can obtain the telescope glasses at almost any optical store.—W. E. M.—Common whiting and alum in equal parts makes a good filling for safes.

Steel from Phosphorized Cast Iron.

A paper by M. Delafond has recently appeared in the *Annales des Mines* on the preparation of steel from iron of this kind, and he finds that the problem is completely solved, both in the Bessemer converter as well as in the ordinary furnace, when basic linings of magnesian lime are employed. The removal of phosphorus is as satisfactory as could be desired, and the silicium is almost entirely removed, while the sulphur is also to a great degree separated. The basic steel is found to be purer and more uniform in texture than acid steel. The soundness of basic steel is more uniform than that of acid steel. Tires of both are found to be statically and dynamically alike. The formation of bubbles and blisters in the basic ingots has been avoided by raising the temperature before casting. In the furnace the basic process goes on more easily than in the converter, and the removal of phosphorus is likewise more complete. Metallurgists have then at the present time two different processes of forming steel, either in the converter or in the furnace: in the one pure kinds of cast iron are treated in the apparatus with acid lining, in the other impure products are subjected to basic linings. The question then arises, if, under otherwise equal conditions, a complete refining follows as well with a basic lining as with an acid, why should not the basic lining be simply employed, so that the steel of greater purity furnished by that method be obtained?

To this it may be replied that when the furnace is used, it would in many cases be advisable to replace the acid lining with a basic one, whereby, in fact, the work would offer no obstacle. It is quite otherwise where the converter is employed. Here the cast iron cannot be worked with a basic lining so advantageously as when the acid lining is employed. It is rich in silicium, which introduces great difficulties when the basic lining is employed. If, however, it be possible so to regulate the smelting furnace that the iron contains less silicium, the intermolecular combustion may be so regulated that no sufficient heat shall be developed to maintain the metal and slag in a liquid state. Thus it is that the preparation of pure cast iron in basic converters presents difficulties. A mixed process may, it is true, be employed; the scorification, first in an acid converter, and then a further refining in a basic converter; only this process would be costly and complicated. The future will decide what is best to be done in this respect. The white raw iron employed at Creusot in the basic process has the average composition: 3=C; 1·30=Si; 1·50–2·0=Mn; 2·50–300 P; and 0·20 S, while the basic (1) and acid (2) steel contain:

	1.	2.
Carbon	0·43	0·40
Silicium	trace.	0·30
Manganese	0·76	0·65
Phosphorus	0·08	0·075
Sulphur	0·029	0·04

The basic lining, consisting of dolomite treated with tar, has the composition: CaO=53; MgO=35·8; and SiO_2=7·7; while the slags at the end of the decarburation (1) and dephosphorization (2) have the following constitution:

	1.	2.
Silicic acid	22	12
Lime and magnesia	47	54
Iron and manganese oxides	11	11
Phosphoric acid	13	16
Alumina and chromium sulphates	5	5

A Marine Engineer's Prophecies.

Mr. James R. Thomsen, one of the builders of the steamship Servia, at the launch of the Aurania, another large first-class steamer for the Cunard Company, lately made the statement, prophetically, that the coming Atlantic steamship would be propelled by twin screws at twenty knots average speed, and would carry no cargo, her profit lying in the fact that she would make fifty per cent more trips. She would carry neither masts nor sails, her twin machinery reducing the probabilities of accidents, and, of course, increasing her safety, while obviating the necessity of the old time auxiliary—sail power. There were fifty large steamships built on the Clyde last year, and about one-half of that number were fitted with corrugated steel furnaces, which are said to effect a saving of from ten to fourteen per cent.

NEW subscribers to the SCIENTIFIC AMERICAN and SCIENTIFIC AMERICAN SUPPLEMENT, who may desire to have complete volumes, can have the back numbers of either paper sent to them to the commencement of the year. Bound volumes of the SCIENTIFIC AMERICAN and SCIENTIFIC AMERICAN SUPPLEMENT for 1882, may be had at this office, or obtained through news agents.

Constitution of the Sun.

In a paper presented to the French Academy (*Comptes Rendus*, xcvi., 136) Faye gives his reasons for believing that our sun and the other large self-luminous heavenly bodies have not yet arrived at either a solid or a liquid state, but are gaseous all the way to the centers. Otherwise, he says, the heat radiated from them would not be so quickly replaced by heat from within, and the surface, consequently, would soon become covered with a solid, non-luminous crust.

Cagniard-Latour has, however, proved by means of some very remarkable experiments that a gaseous mass can acquire the density of a liquid without changing its state of aggregation, provided both temperature and pressure are high enough at one time. If, then, the external strata of the solar atmosphere, where all matter is in an elementary or dissociated state, should cool sufficiently for the elements to enter into chemical combination, if the vapors of metallic calcium, magnesium, and silicium, mixed with oxygen there, on cooling should form clouds of lime, magnesia, and silica, for example, these clouds would sink to the interior, where they would again be dissociated, while at the same time they would drive the hotter particles upward, so that an approximately uniform temperature would be maintained until the whole mass had gradually cooled to such an extent as to assume the liquid and afterward the solid state.

Faye bases his hypothesis on the spectroscopic observations of many years, and on Carrington's study of sun spots, which show that the currents are all in zones parallel to the equator, while there are none from the equator toward the pole. Besides this, the flattening of the sun and the slow motion of sun spots near the poles are more easily explained on this hypothesis of Faye than on those hitherto in vogue.

Illuminating Gas in Russia.

The Chemical Society in St. Petersburg recently appointed a committee to determine what was to be understood by "illuminating gas of best quality." From their report we abstract the following points:

1. A good illuminating gas must give, when burning about 100 liters per hour in a bat wing burner, an illumination equivalent to 10 normal spermaceti candles, that burn 7·78 grammes per hour.

[One hundred liters equals 3·53 cubic feet, while 7·78 grammes = 120 grains. This requirement corresponds very nearly with our 14 candle gas.—ED.]

2. Since the material used in making gas, as well as the way in which it is made, has an effect on the value of the gas, it will be necessary, after a standard has been fixed on for the quality of the gas, for the city to establish an inspector to constantly watch the quality of the gas sent out.

3. Not only the illuminating power of the gas, but its composition, is of importance to consumers who use it indoors, hence the comptroller or inspector must also test it with regard to its chemical purification, and for this purpose also a standard must be fixed upon.

4. After estimating the quality of the gas, attention must also be given to the methods of illumination, since a good illumination depends, not on the quality of the gas alone, but on other causes, as, for example, on the pressure, the state of the pipes, the condition of the burners, etc.

5. The society advises sending a competent scientific person to Paris and other cities where such inspection is carried on, to study the methods and means employed.

Nottingham Worms.

In all angling localities, the merits of Nottingham worms for angling purposes are fully recognized; but only a comparatively few people are aware of the trouble that is expended upon them. This industry affords employment to a large number of persons throughout a considerable part of the year, who, every favorable night, collect the worms from their happy hunting grounds in the meadows. Naturally, the supply in wet weather is more abundant than when the atmosphere is dry, although some sort of a harvest can even then be obtained by watering the ground. The wormers are provided with lanterns, and have to exercise some considerable agility in catching their prey, as, if disturbed by any noise, they pop back into their holes. As soon as the worms are brought in from the country, they are taken to the 'farmer,' who places them in common field moss, and there they remain until they are as tough as a piece of India rubber, which is a proof of their being in good order to use as bait, as a freshly caught worm is extremely tender, and breaks up readily when put on a hook. The worms are generally kept in moss from three or four days to a week, which is the longest period they can be preserved in good order. The worms are frequently picked over, in order to exclude all those that are broken and mashy; and when fit for use, they are usually sold for three and sixpence or four shillings per thousand, packed up in canvas bags filled with moss. For this purpose, only the plump and healthy worms are selected.

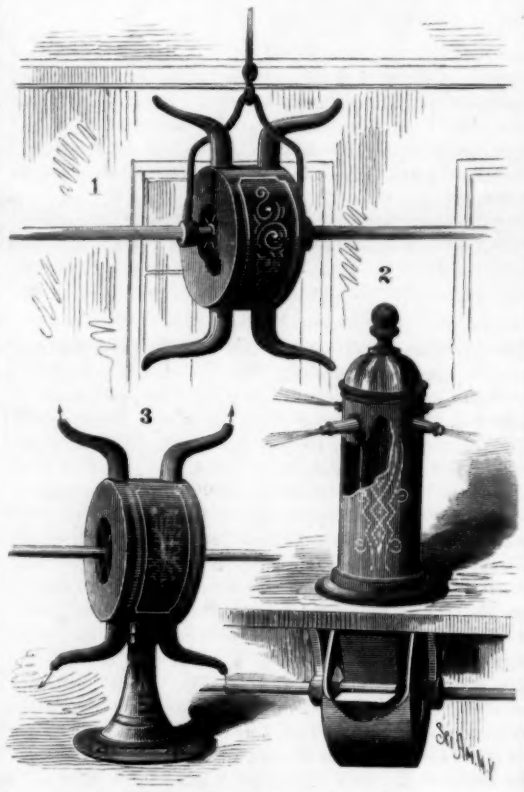
[The above from *Chambers's Journal* suggests a new industry not yet introduced into this country, and a useful hint to our fishermen respecting the toughening of their bait.—ED.]

IN Japan, one of the staple articles of food, fresh and pickled, is the daikon, a great radish, that grows 2½ feet long and 4 inches in diameter.

NEW FANNING APPARATUS.

We give an engraving of an improved fanning apparatus designed for cooling purposes, and to be used in hotels, restaurants, private residences, offices, and in all other places where it is desirable to keep the air in circulation. It may be made in various sizes, and driven by any available motive power; the smaller sizes being propelled by a spring or weight, and the larger ones by steam or water power, gas or caloric engines, according to locality, extent of use, etc.

The apparatus consists of a fan formed of a series of wings or blades mounted on a shaft and inclosed in a casing, the casing having discharge pipes opening in various directions, according to the requirements. The apparatus may be suspended, as in Fig. 1, placed beneath a table or floor, as in Fig. 2, or supported by a standard, as in Fig. 3.



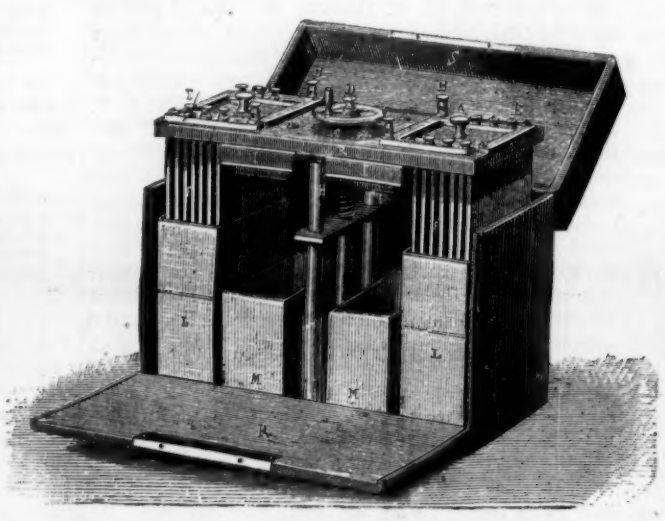
REIMERS' FANNING APPARATUS.

A patent has lately been granted for this invention to Mr. Jacob Reimers, of No. 1,325 Sturtevant St., Davenport, Iowa.

NEW PILE FOR GALVANO CAUTERY.

Mr. Chardon, a French manufacturer of electrical apparatus for medical and surgical purposes, has recently devised a pile which is specially designed for the practice of galvano cautery, and which does away with some of the serious inconveniences inherent to other piles of the kind that have hitherto been employed.

In this new apparatus, which is shown in the annexed cut, the elements are inclosed in an easily transportable box or case, and are so constructed that there shall be no danger of the fluid's spilling. It takes but a few minutes to mount and use the cautery, and but a few minutes also to close up the apparatus again to make it transportable.



NEW BATTERY FOR GALVANO CAUTERY.

The apparatus consists of a box, whose cover, S, and one side, R, are hinged, and within which is fixed a metallic support formed of three vertical columns united at their upper extremity by a horizontal crosspiece. Into the middle column, which carries a thread, enters a screw, while into the other two, which are smooth, enter two cylinders, H, that act as slides. This screw and these slides support, by means of a properly arranged device, a wooden tablet on which are fixed all the pieces that are necessary for the working of the apparatus. The head of the screw traverses this tablet and terminates in a wheel, C. It follows, from the well known properties of the screw, that the tablet, which cannot revolve because of the two slides, H, may be made to rise or descend by turning the wheel, C, in one direction or the other. Beneath the tablet and toward the extremities, at F, are situated the zincs and carbons. There are three of the former on each side, with four alternating carbons. These seven plates together do not take up much space in the box, but leave room for two quite thick sheets of rubber, I I, and four ebonite troughs. These latter are of different heights, those (L) containing the exciting liquid (solution of bichromate of potash and sulphuric acid) being nearly as high as the external case, and the others, M, being about half the height.

When it is desired to use the pile, the tablet is raised by revolving the screw, and the troughs, L, half full of liquid, are placed against the extremities of the box and secured in position by means of the troughs, M. Then, by revolving the screw in the opposite direction, the tablet is made to descend, and the zincs and carbons are caused to enter the liquid gently without splashing. If the circuit is closed, the current then begins to pass. The intensity of the latter is regulated by plunging the zincs to various depths into the liquid.

When the operation is terminated, and it is desired to carry the pile to another place, the tablet is raised high enough to free the extremities of the carbons and zincs, and the respective positions of the troughs, L and M, are changed. Then, by reversing the motion of the screw so as to cause the tablet to descend, the sheets of rubber, I, are pressed against the edges of the troughs containing the liquid with sufficient firmness to form hermetical covers to them. The case may then be closed preparatory to removal. It may be easily seen that no liquid can flow out, owing to the fact that the troughs that contain it are tightly closed, and that the small portion that drips from the zincs and carbons cannot injure the rest of the apparatus, inasmuch as it is caught in the troughs, M.

The zincs and carbons employed are about fourteen centimeters in width in each direction. The three zincs on each side, as well as the four carbons, are united for quantity, in such a way that two elements of wide surface are obtained. The terminals that are observed on the upper side of the tablet permit of employing at will one or the other of the elements only. On the contrary, the two elements mounted for tension may be used by attaching the conducting wires to one of the terminals of each of the elements, communication being established on another hand by a wide band of metal.

The carbons are platinized, and, toward their upper part, are invested with a layer of copper to which is soldered the strip of metal that unites the four carbons of each element to form a single one. This arrangement, which secures a continuity of the contacts, is of a nature to keep the resistance of the pile constant, and consequently to contribute to the constancy of the currents.

Although this apparatus has been introduced but a short time, it is being used in some of the hospitals at Lyons, Montpellier, and Brussels, and, if we mistake not, at the Bichat Hospital in Paris.—*L'Electricien.*

An Old Church in Arizona.

The most interesting of all sights is the grand old mission church of San Xavier, nine miles from Tucson, on the Papago reservation. This mission was founded in 1654, when the Papago (or Pima) Indians were supposed to have accepted the Christian religion. The Church of San Xavier was begun about the year 1700 and finished in 1798, excepting one of the towers, which is yet unfinished. The style of architecture is Moorish. The lines are wonderfully perfect. It is in the form of a cross, 70 x 115 feet, and has a well formed dome. A balustrade surmounts all the walls. The front is covered with scroll work, intricate, interesting, and partly decayed. Over the front is a life-size bust of St. Xavier. The interior is literally covered with frescoes. The altar is adorned with gilded scroll work.

The statues are as numerous as the paintings. The tiling on the floor is much defaced and but little is left. That of the roof is nearly all as perfect as when laid. Its manufacture is one of the lost arts. There is a chime of four good sized bells in the tower that have a soft, sweet sound. Ascending to the roof, you walk up long, narrow stairs in solid walls. But one can go at a time. The same is true in going to the gallery of the church.

It is marvelous that so long ago, and in such a place, such architecture, ornaments, painting, and sculpture were so well executed. You are admitted by two of the Papago signiors, who have it in charge. The admittance fee is 50 cents for each person.—*Denver Tribune.*

ACCORDING to the new act passed by the Maine Legislature, salmon, land-locked salmon, and trout, except in tide water, cannot be taken with nets, seines, weirs, or traps. The taking of land-locked salmon less than nine inches in length and of trout less than five inches is unlawful; also the transportation of more than fifty pounds of land-locked salmon or trout by any one person at a time.

IMPROVED FILTERS.

(*Continued from first page.*)

clearly understood. In filters of 40 and 50 inches diameter, the inlet is at one side of the bottom and the outlet on the opposite side, so that the water must be subjected to the filtering action of a sufficient quantity of sand. But in filters of larger diameter the water is admitted through the center, and passes upward and outward to the circumference, as will be explained in description of filter No. 3. The distinguishing feature of filter No. 2 is the process of washing the sand. They are set up in series of two or more, because one of them, in turn, contains no sand, but is idle while the others are filtering. For example, in a series of three filters, as shown in the cut, two of them are filled with sand and are used simultaneously while filtering, the third standing idle and containing only water.

In washing, suppose the last in the series of three to be the idle one. The outlet valve, D, in the first filter, is closed; the waste valve, I, and the valve at the top of the pipe, E, are opened. The water coming in through the valve, B, can then only escape through the pipe, E. This pipe in large filters is made tapering and terminating very near the bottom of the filter. Through this pipe the water rushes up into and through the horizontal pipe, H, and discharges into the top of the third filter. In doing so the water carries with it the sand from the first filter, conveying it all into the third filter in about ten minutes. This carrying process is facilitated by a current of water forced from the upper part of the filter through the small pipe, C, loosening up and helping to separate the impurities from the sand during its passage through the pipe, H. As the sand falls into the water in the third filter, the separated impurities flow out with the excess of water through the open valve, I, into the waste pipe; the sand, being thoroughly washed, settles and remains in the filter. Now, this washing of the sand from the first filter into the third, being accomplished, the valves, C and E, in the first filter, and waste valve, I, in the third, are closed; the inlet valve, A, in the third filter and its outlet valve on the opposite side are opened, and filtration is immediately commenced. Next the middle filter, or number two, may be washed, its contents being washed into the first filter precisely as had been done in the preceding case. Following in order, at the proper time, the sand in number three is discharged and washed into number two. And so, in regular order of succession, the filters are cleansed. About twenty minutes or half an hour each day is all the time required to keep a series of three in perfect order.

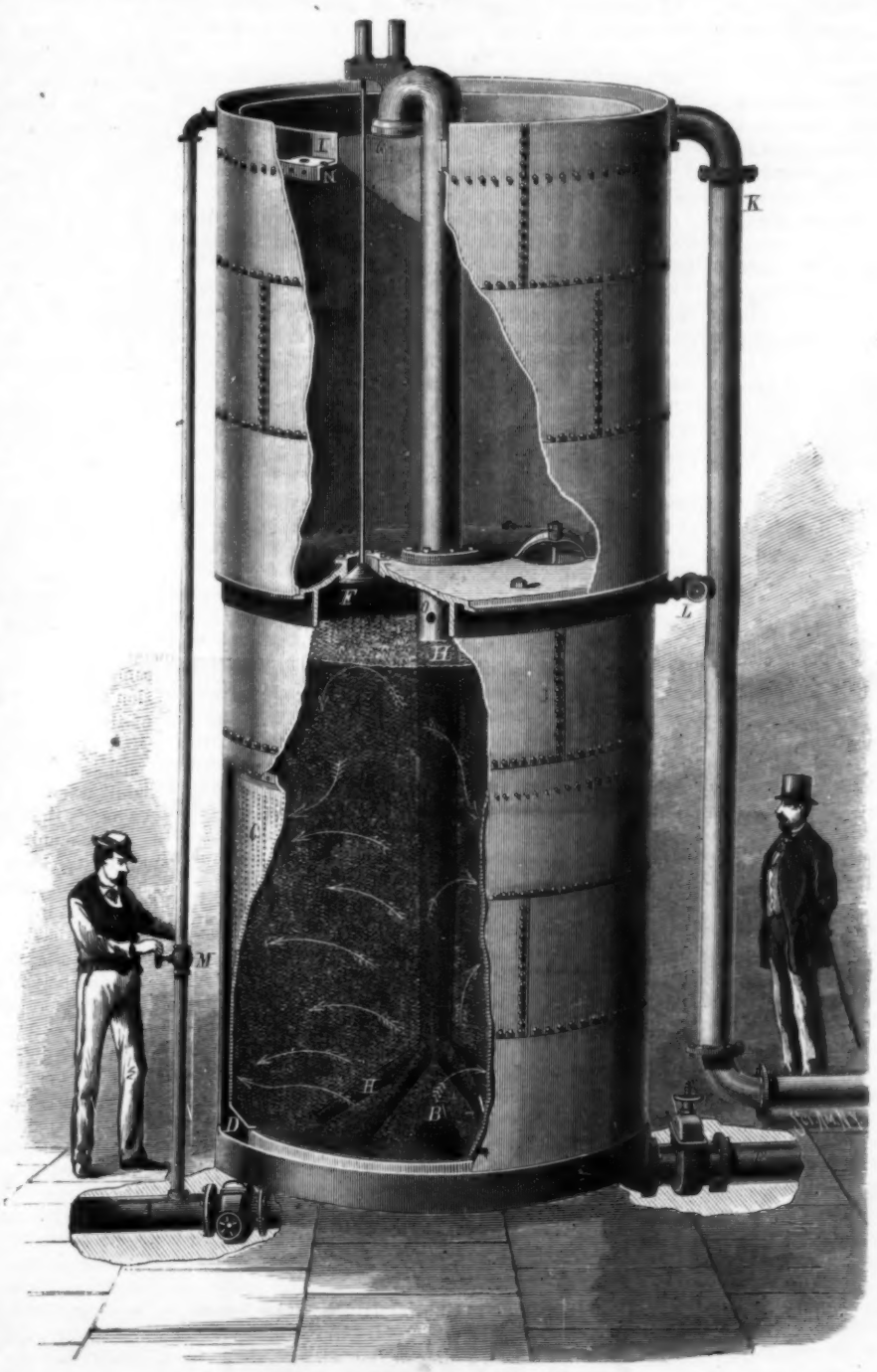
As before mentioned, this style of filter is made in gangs or series of any desired number, one of the series being always employed in rotation for washing the sand.

The Hyatt filter No. 3 differs from No. 2, not in principle, but only in construction; the object being to make a single filter complete in itself, both for filtering and washing purposes. In the great majority of cases, where more water is to be filtered than is used in an ordinary house or small steam boiler, the No. 3 filter will be recommended. But as it occupies more vertical space than No. 2, some industries having limited vertical space might find No. 2 better adapted to their conditions.

As will be seen in the illustration, filter No. 3 is constructed with two compartments, one above the other. The lower compartment is the filter proper, and the upper one is simply a tank used only during the operation of cleansing the sand. The cut shows a filter eight feet in diameter, and, including both compartments, twenty feet in height. In this size the water is admitted in the center, and passes upward and outward to the circumference of the filter, so that all the water is filtered through four feet of sand.

The operation in this filter is as follows: The water to be filtered is admitted through the valve, B, and, as it is filtered, passes through the perforated screen, C, which surrounds the sand and is supported by the outer shell. Ample room is provided between the screen and the shell for the passage of the filtered water down into the annular space, D, from which it issues through the outlet valve and pipe, E. This arrangement of large filters supplied with water in the center furnishes the greatest possible filtering capacity on a given ground space, and is especially adapted to large industries and to towns and cities.

When the sand in this filter is to be washed, the valve, F, in the head is opened and the outlet valve, E, closed. The water then rises till the upper compartment is filled. Then the valve, F, is closed, and valve, G, at the top of the pipe, H, is opened. The contents of the filter can then only escape by way of the pipe, H, through its branches, which reach nearly to the bottom of the filter. The pressure of water coming into the filter forces the water and sand in a steady stream up through the pipe, H, and discharges the whole into the upper compartment. Water also coming into the pipe, H, by the aperture, O, under the head, aids the flow of sand upward, and also assists in washing its particles free from the accumulated impurities. The water in the upper receptacle, as it receives the incoming flow, effects a complete separation of the impurities gathered in the sand, and they flow away with the excess of water into the overflow trough, I, and out through the waste pipe, K. In from ten to fifteen minutes, according to the supply of water, all of the sand in the filter (about 500 bushels in this size) is discharged and thoroughly cleansed into the upper tank. Now the filter below contains only water. To give it back its sand the supply pipe is closed, the valve, F, in the head, and valve, L, leading to the waste pipe are opened. Immediately the sand and water commence descending through the opening, F, the sand settling and filling the filter, while the excess of water escapes by the waste pipe.



THE HYATT FILTER NO. 3.

In this operation the sand is washed through the water a second time, and of course is left in a still finer condition for filtration. As the sand is descending, when two-thirds or three-fourths thereof have passed through the opening to the filter below, water is admitted into the trough, I, at the top, from which it falls in small streams through perforations in the bottom of the trough, washing the sand away from the sides of the tank and carrying it all through the opening into the filter underneath; then the valves, F, G, and L, are closed, and filtration resumed.

The largest size of filter (No. 3) is 10 feet in diameter and 20 feet high, having a capacity of 750 bushels of sand, and will filter from 500 to 750 gallons of water per minute. Twenty such filters will purify the water for a city requiring 10,000,000 gallons of water daily, and give a surplus; and the services of one man only would be required to thoroughly wash them once a day. The average waste of water in cleaning the sand in either style of these filters is about one per cent of the whole amount filtered. These remarks apply to the average water requiring filtration; but a larger percentage of water for washing, would be demanded to filter the water in some of the Western rivers, containing large quantities of clay.

In most cases filters above 40 inches in diameter are built entirely of boiler iron, and constructed for high or low pressure, as may be required. They are thoroughly bituminized interiorly to prevent rusting, and, it is believed, will last as long as the best constructed water mains; and as there is no waste of sand, there is nothing to repair, except the ordinary wear of water valves, thus confining the cost of maintenance to the expense of one man about fifteen minutes a day to do the washing of each filter.

It will be seen that, with these water purifiers, the Newark Filtering Company have the means of filtering river, pond, or lake water in any quantities, large or small, and in all situations and under any pressure required. Whether for house purposes, hotels, steam boilers, manufacturing industries, villages, or cities, they can meet any want, and claim the ability to filter a greater quantity of water, at less cost of installation and maintenance, than can be done by any other known means of mechanical filtration.

These filters are patented in the United States, Canada, and principal European countries.

God in Nature.

In a recent scientific lecture Professor C. A Young, the astronomer, of Princeton College, used the following language: "Do not understand me at all as saying that there is no mystery about the planets' motions. There is just the one single mystery—gravitation—and it is a very profound one. How it is that an atom of matter can attract another atom, no matter how great the disturbance, no matter what intervening substance there may be; how it will act upon it, or at least behave as if it acted upon it, I do not know, I cannot tell. Whether they are pushed together by means of an intervening ether, or what is the action, I cannot understand. It stands with me along with the fact that when I will that my arm shall rise, it rises. It is inscrutable. All the explanations that have been given of it seem to me merely to darken counsel with words and no understanding. They do not remove the difficulty at all. If I were to say what I really believe, it would be that the motions of the spheres of the material universe stand in some such relation to Him in whom all things exist, the ever-present and omnipotent God, as the motions of my body do to my will—I do not know how, and never expect to know."

Arizona's Mineral Wealth.

It is but a few years ago that Arizona was looked upon as simply a worthless desert waste, useless alike for farming and stock raising, while the owners of a few small mines which were known and worked labored under the great disadvantage of having to rely upon the slow ox and mule teams for the transportation of their supplies and products. Communication with the outside world was not only difficult, but the pioneer miners were in constant dread of Indian raids upon them that it was impossible to develop Arizona Territory with much success or profit. But a great change has taken place since the completion of the Southern Pacific Railroad across the Territory, and although the railroad does not extend directly to any of the mining camps, the increased facilities for transportation, and the opening up of the territory in consequence of it, have increased its population and developed its mining interests within the past two or three years wonderfully, and specially during the year 1882 the territory has made great advances in its resources.

From statistics recently published it appears that Arizona ranks third among the States and Territories in the production of gold, silver, copper, and lead, the total production of these metals aggregating in value for 1882—$11,702,293.

ONE ton of cotton seed yields thirty six gallons of crude oil, worth about $18. The hull from a ton of seed weighs about 900 pounds, and the meal before pressing weighs 1,100 pounds. The oil cake is worth $27 to $30 per ton. It is calculated that there is a net profit of about $9 in grinding the seed of a bale of cotton.

Safety Devices for Vessels.—Official Requirements.

At the annual meeting of the Board of Supervising Inspectors of Steam Vessels, held in Washington, January, February, 1883, in pursuance of Section 4,405, Revised Statutes of the United States, the following devices were approved by the board, and have also received the approval of the Secretary of the Treasury:

Holman's life-preserving bed (when constructed of at least fifteen pounds of solid cork and cork shavings, as a life-preserver or float for one person, on lake, bay, sound, and river).

Life-preserver, invented by Eliza P. Coggswell (when containing not less than six pounds of granulated cork, prepared in paraffine solution, and having a buoyancy of not less than twenty-four pounds, on lake, bay, sound, and river), with the further qualification that neither the board nor the Secretary of the Treasury "means to assert or admit, or in any way imply, that Mrs. Coggswell is the inventor, and legally entitled to a patent or other privilege."

Renton safety boat plug; James Snelgrove, automatic boat plug; Daniel B. Eddy, patent sea life-boat; Dean & Co., improved diagonal life-boat (for lakes, bays, and sounds); Herreshoff Manufacturing Company, pop safety valve; W. E. Pierson, pop safety valve; George E. Collyer, safety valve; Edwin A. Hayes, life-raft.

Some of the rules were amended as follows:

RULE 13.—Steamers navigating rivers only (except ferry-boats, freight boats, canal boats, and towing boats, of less than one hundred tons) must have one good, substantial boat.

Freight, ferry, canal, and towing steamers, of less than fifty tons, must be equipped with boats as, in the opinion of the inspectors, may be necessary, in case of disaster, to secure the safety of all persons on board.

Steam ferry-boats of fifty tons burden and over must be supplied with life-boats as, in the judgment of the inspectors, will best promote the security of life on board such vessels in case of disaster, according to the average number of passengers carried per trip.

Steamers making excursions under a permit must have at least one life-boat, and shall be equipped with other life-boats, or their equivalents, as, in the judgment of the inspectors, will best secure the safety of all persons on board in case of disaster.

Passenger steamers navigating the Red River of the North, and rivers whose waters flow into the Gulf of Mexico, must, in addition to the boat required in the first paragraph of this rule, be equipped with one life-boat of the buoyancy and capacity named in the *Example* in Rule 12, for every sixty passengers allowed, including the crew. One of the life-boats, unless exempted by the Supervising Inspector, must be made of metal.

All metallic life-boats hereafter built shall be furnished with a suitable automatic plug.

Passenger steamers navigating rivers other than the Red River of the North, and rivers whose waters flow into the Gulf of Mexico, must be supplied, in addition to the boat required by the first paragraph of this rule, with life-boats in proportion to their tonnage as follows:

Steamers between 100 and 300 tons, 1 boat; 300 and 600, 2; 600 and 900, 3; 900 and 1,200, 4; 1,200 tons and upward, 5.

Provided, however, that river steamers required to carry more than two boats may, where the owners prefer to do so, supply the boat capacity above that number with a good, substantial life-raft or rafts, such raft or rafts to be of equal aggregate carrying capacity of the boats so omitted.

These life-boats shall not be of less dimensions than those named in the example in Rule 12, unless, where smaller life-boats are employed, their aggregate capacity shall equal the aggregate capacity of the larger boats.

No steamer embraced in this paragraph shall be required to have more life-boats, or of a greater capacity, than sufficient to carry the passengers allowed by the certificate of inspection (including the crew). One of the life-boats, unless exempted by the Supervising Inspector, must be made of metal. The carrying capacity of the life-boats for steamers herein mentioned shall be determined by multiplying the length, breadth, and depth together, and dividing their product by five.

Passenger steamers navigating the ocean, Northwestern lakes, bays, and sounds of the United States, must be equipped with life-boats in proportion to their tonnage as follows:

Steamers under 100 tons, 1 boat; steamers between 100 and 200 tons, 2 boats; 200 and 300, 3; 300 and 400, 4; 400 and 500, 5; 500 and 1,000, 6; 1,000 and 1,500, 7; 1,500 and 2,000, 8; 2,000 and 2,500, 9; 2,500 and 3,000, 10; 3,000 and 3,500, 11; 3,500 and 4,000, 12; 4,000 and 5,000, 13; 5,000 and above, 14.

All these boats must be of proper size, and substantially built with reference to the trade in which the steamer is engaged: *Provided, however*, That no steamer shall be required to have more life-boats than sufficient to carry the passengers she is allowed by her certificate of inspection, together with her officers and crew.

A portion of the life-boats required on lake, bay, sound, and ocean steamers may be substituted by their equivalents in *approved* life-rafts when, in the judgment of the inspectors, it can be done with safety.

All steamers built for the navigation of oceans, Northwestern lakes, and sounds (meaning in waters sufficiently rough to swamp boats), shall be equipped with life-rafts in proportion of one at least to every two life-boats required.

RULE 14.—All life-rafts and floats composed of hollow cylinders must be rated in their carrying capacity according to the cubical dimensions of such cylinders, in the ratio of one person to every three cubic feet for ocean steamers, and two cubic feet for lake, bay, sound, and river steamers. Such life-rafts and floats must be suitably equipped with life-lines and oars.

All rubber or canvas life-rafts shall be kept inflated at all times.

RULE 23.—Steamers required to be provided with double-acting steam fire pumps, or other equivalent for throwing water, shall be equipped according to their tonnage as follows:

For a steamer of not more than two hundred tons burden, four inches stroke and two inches diameter of plunger, or its equivalent.

Of more than two hundred and not over five hundred tons burden, seven inches stroke and four inches diameter of plunger, or its equivalent.

Of more than five hundred and not over one thousand tons burden, seven inches stroke and six inches diameter of plunger, or its equivalent.

Of more than one thousand and not over fifteen hundred tons burden, ten inches stroke and six inches diameter of plunger, or its equivalent.

Of more than fifteen hundred and not over two thousand tons burden, ten inches stroke and eight inches diameter of plunger, or its equivalent.

Of more than two thousand and not over twenty-five hundred tons burden, twelve inches stroke and eight inches diameter of plunger, or its equivalent.

Of more than twenty-five hundred and not over three thousand tons burden, twelve inches stroke and ten inches diameter of plunger, or its equivalent.

Steamers are not restricted to the above particular proportions for fire pumps; any other dimensions equal to or greater in capacity may be allowed; and no fire pump thus provided for, excepting upon ferry-boats, shall be placed below the lower deck of the vessel.

The diameter of the pipes leading from the pumps must in no case be less than that of the discharge opening of the pumps.

A rotary pump, when driven by an engine independent of the main engine, or a steam siphon pump, may be considered as an equivalent for the double-acting fire pump, and used as such when equal to it in efficiency, and the degree of capacity required.

RULE 57.—It shall be the duty of the master of every inspected steamer carrying passengers on the ocean, lakes, gulf[s], or bays, when such steamer is under way, to cause to be prepared a station-bill for his own department, and one, also, for the engineer's department, in which shall be assigned a post or station of duty for every person employed on board such steamer in case of fire or other disaster; which station-bills shall be placed in the most conspicuous places on board for the observation of the crew. And it shall be the duty of such master, or of the mate or officer next in command, once at least in each week to call all hands to quarters, and exercise them in the discipline and use of the fire pumps, and all other apparatus for the safety of life on board of such vessel, and to see that all the equipments required by law are in complete working order for immediate use; and the fact of the exercise of the crew, as herein contemplated, shall be entered upon the steamer's log-book, stating the day of the month and hour when so exercised, and any neglect or omission on the part of the officer in command of such steamer to strictly enforce said rule shall be deemed cause for the revocation of the license of such officer. Upon navigable rivers, the captains of all passenger steamers shall be required to maintain a strict discipline and organize the officers and permanent crew so as to act with promptness in extinguishing fire; and the captain shall cause to be prepared at least two station-bills, assigning the officers and permanent crew to definite places; said station-bill shall be conspicuously placed, under glass, near the inspection certificate.

The Atlantic near the North American Coast.

At the recent annual meeting of the United States National Academy of Sciences, Professor Verrill, of Yale, gave the results of various observations made during eleven years off the coast between Chesapeake Bay and Labrador by the United States Fish Commission. One of these results is, that there is an error in maps and charts, in placing the warm belt, or Gulf Stream, too far from the shore by 30 or 40 miles. From the shore to about 60 miles out the fauna is Arctic; in the warm belt it is tropical or sub-tropical. The 100 fathom line has been taken to mark the border of the Gulf Stream; but it would be more correct to say the 65 or 70 fathom line.

Professor Verrill holds that there is no variation in the body of the stream (as has been supposed) in summer and in winter, though there is some variation in the surface water. The proof lies in the distinct line of separation of the two kinds of life on the bottom; if there were variation there, the sub-tropical life would be destroyed. The portion of the warm belt south of the New England coast, 70 to 120 miles from the coast, teems with life. In 1880 the dredges brought up 800 species of fauna, over one-third of which were wholly new, including 17 kinds of fishes, 270 of mollusks, and 90 of crustacea. To the 100-fathom point there is a gradual descent from the shore, then comes a precipitous descent to 1,000 fathoms or more. The warm belt seems to extend down this precipice only about 125 fathoms. Among other points noted in the animals found at great depths is their (generally) red or orange-yellow color; supposed to be a means of defense by rendering invisible. The bottom of the Arctic belt is a coarse gravel or sand; but that of the Gulf Stream is of sand so fine that the grains can only be distinguished with the microscope. Mixed with minute shells, this sand seems to form a bed as level and hard as any floor. Bowlders are sometimes found on this bottom among the dense animal and vegetable life with which it is carpeted; they have probably dropped from ice cakes. The dredges sometimes brought up a rock, possibly of Pliocene age, filled with fossil shells, like those now found on the bottom. The absence of all vertebrate fossils is remarked on. The dredges, also, never brought up any evidence of the existence of dead vertebrates, though the water swarmed with sharks, dolphins, etc., nor was any evidence of man's existence met with, except an India-rubber doll, dropped from some vessel. Yet the territory dredged was in the track of European vessels, many of which must have gone down there and lives been lost. Such facts led Professor Verrill to doubt the negative evidence in geology.

Coal Dust Explosions in Mines.

There can be no doubt that rich coal dust is inflammable and dangerous, especially in the presence of marsh or coal gas. The behavior of some dust shows that when thickly suspended in air and ignited, the flame runs along similarly to a train of gunpowder. In the presence of so small a quantity of gas that the Davy lamp is incapable of detecting, its violence is much more marked; and in this way it becomes a vehicle conveying flame from one part of the workings to another. The gas may not be in the necessary proportion to cause an explosion, but by the concussion of a powder shot dust is dislodged and may take fire. If this happens in the neighborhood of a local accumulation or "pocket" of explosive mixture, combination takes place, and the heat generated would be sufficient to subject the particles of dust to destructive distillation, and coal gas would be generated, which would ignite explosively and extend the work of destruction.

A charge of 1½ to 2 pounds of powder will carry flame in air about 20 feet; with coal dust in suspension it will carry flame double the distance; and with a small proportion of gas and dust it will go still farther, especially in the direction of the ventilating current of air. Firing shots and bringing down the coal will sometimes liberate pit gas, as will also falls of roof and changes in the barometric column; and although the firing of the gas thus liberated would not be in all cases at all a serious matter *per se*, yet when the same occurs in a dusty atmosphere the effects of the explosion are aggravated according to the quantity and character of the dust. My own opinion is that coal dust will not of itself explode except it be in a dense cloud, so dense that the particles, being very close together, are able to communicate ignition to each other, and the temperature, I think, must be higher than that experienced in the air of a mine.

But assuming the above conditions, and the ignition of the dust to have been effected, the production of coal gas by the decomposition of the coal dust would probably be so rapid that the oxygen of the air would soon be used up to form carbonic acid, water, and sulphurous acid. The dreaded after damp would permeate the entire workings, to the destruction of life. Flour, rice, and cotton dusts have caused explosions in mills both here and abroad; destroying life, and setting fire to the premises. Doutless coal dust is a source of great danger in mines, especially such dusts as those from superior gas producing coals. The dangers are increased by the presence of minute quantities of pit gases, and dusts which refuse to inflame in atmospheric air will do so if a small quantity of coal gas or pit gas be added thereto.—*C. E. Jones.*

American Pig Iron in 1882.

From reports received from all the makers of pig iron in the United States, the American Iron and Steel Association finds that the product of pig iron last year was 4,623,323 tons, or nearly half a million tons more than was made the year before. The yields of the different kinds of pig iron for the two years are shown in gross tons in the table below:

	1881.	1882.
Bituminous	2,025,236	2,176,855
Anthracite	1,548,627	1,823,338
Charcoal	570,391	623,130
Total	4,144,254	4,623,323

The stock of pig iron held unsold in the hands of makers at the close of 1882 was 383,655 tons. At the close of 1881 the stock on hand was 188,300 tons.

Mica Prisms.

At a recent meeting of the Physical Society, Mr. Lewis Wright read a paper on the "Optical Combinations of Crystalline Films," and illustrated it by experiments. He exhibited the beautiful effects of polarization of light, and the Newtonian retardation by means of plates built up of thin mica films and Canada balsam. The wedges thus formed gave effects superior to those of the more expensive selenite and calcite crystals. The original use of such plates is due to Mr. Fox, but Mr. Wright showed many interesting varieties of them, including what he termed his "optical chromotrope," formed by superposing a concave and one-fourth wave plate on each other. Norenberg's combined mica and selenite plates were also shown.

Correspondence.

"Flying."

To the Editor of the Scientific American:

Notwithstanding all your amusing correspondent has cited in the issue of Feb. 22, concerning that remarkable turkey, the albatross still remains, I think, the largest flying bird, that is, it is the largest bird whose efforts at flying may be taken as a high example of the expenditure of vital energy for that particular form of locomotion; it is, in short, the highest type of "flying creature" considered essentially as such, and in flying will undoubtedly surpass any other large bird.

Though less perhaps in weight than the turkey, he spreads a far greater flying surface to the air and performs the mere act of flying in a far more representative manner than other birds of greater strength.

In the article to which Mr. Goodsell refers I think neither weight nor bulk, or more properly speaking volume, is meant, but rather that the albatross is simply the largest approximation to a flying machine that Nature has given us, and as such is the best model, and in so far he is undoubtedly right. In the next paragraph, however, your correspondent states that which is far more open to criticism.

"The bird," he says, speaking in a very general way, "has the same relative advantage with his wings in the air as the man has with his legs on the ground, has he not?"

Well, I should say most emphatically not, and at the same time I believe this same misconception lies at the base of most devices for flying that have been condemned on their first trial. There is no use in being scientific by halves, and I think, had the author of that interesting comparison between the five turkeys and the man made a simple draught, illustrating what the turkeys may be fairly estimated to do at one end of the rope and what the man will do at the other, he would have seen the absurdity of the situation. And yet the birds do have in a certain sense greater muscular power than the man; but this assertion must not be taken with too broad a meaning; it only means that they have greater proportional strength for a particular purpose; in other words, exerted through a particular set of muscles; or, to be still more precise, of the total amount of vital energy of his system the bird can use a far greater proportional part in the exercise of those particular muscles adapted to locomotion than man or any vertebrate animal can do; and fortunately for the mechanic, to make things consistent, we find conversely that Nature has also made a far greater proportion of the entire machinery of the bird system subservient to this method of expending its energy. A muscle burns more or less carbon and develops more or less heat in proportion to its size. In no other animal do we find any muscles to compare in relative size to the breast muscles of the bird, consequently no such relative expenditure of the total energy of the system. It is for these reasons that the comparison instituted was absurd. Mathematically speaking, the quantities compared were not homogeneous. Aerial navigation is probably not beyond the contrivance of human ingenuity; aerial flight however is, and is evidently not within the design of Nature.

F. JARVIS PATTEN.

U. S. Army.

The Bohemian Waxwing.

To the Editor of the Scientific American:

This erratic straggler from the north being rarely met with, and his habits as yet but imperfectly understood, it may not be amiss to record his visits to our latitude, which are both irregular and infrequent.

I have observed two small flocks of this species (*Ampelis garrulus*, L.) in the neighborhood of Burlington, Vt., which may have been the terminus of their southern migration, in the first instance on November 24, 1882, and latterly on the 21st of January. Their low, plaintive note, a sort of conversational undertone, first attracted my attention. Like other denizens of the frozen zone, they have not yet acquired a fear of man, and seem wholly indifferent to his presence. In one instance a party of eight individuals were perched on the lower branches of a cedar, leisurely preening themselves, making their toilet evidently before resuming flight. Though close upon them, their sleepy eyes took no apparent notice, and when wishing to see them fly, I had almost to shake them from their perch. They take to flight simultaneously, and are off in a flash, uttering, as they whirl past your head, their characteristic note of *zi-zi*.

It has been suggested that these birds are either forced to their southern migration by the scarcity of food in their polar home, or else are brought down by the great cold waves which are known to arise in high latitudes. Their trig appearance, when they reach us, at least, would suggest anything but a scanty diet; yet, as the food question is paramount among all animals, it may in this case partially determine their movements.

These dwellers of the hyperborean regions forsake their Alaskan and Siberian evergreens, and, borne, perhaps, on the crest of a wave, suddenly alight before your door.

The name *chatterer*, which has been frequently applied to them, as far as the species is concerned, is a cruel satire on its remarkably silent habits. The Bohemian waxwing is the personification of mystery, and seems to go about with a bundle of secrets under its wing. As evidence of this, but especially, of course, owing to his circumpolar residence, we see how long it has taken to collect the little information we now have respecting his history. Wilson, who traveled, as he tells us, ten thousand miles in the pursuit of birds, made no report of the species, which Bonaparte did not observe east of the Mississippi. Audubon met with it in Maine, and it has since been seen at rare intervals in the Northern states, Massachusetts being usually its southern limit for New England.

It is interesting to note the superstition with which this bird was in more ignorant times associated. His visits to Europe are historically recorded, and were looked upon as the precursors of war and pestilence, at times appearing in such numbers (as an old writer observed) as to obscure the sun.

Preferring the inhospitable forests which circumscribe the pole, he lives far from the haunts of men, only occasionally permitting them to form a brief acquaintance by his infrequent visits to their latitudes.

F. H. HERRICK.

Burlington, Vt., March 16, 1883.

Natural and Artificial Paraffines.

F. Krafft, of Basel, Switzerland, contributes an article to the *Chemiker Zeitung* on the identity of normal paraffines with the paraffines from brown coal, from which we translate the following:

Owing to their chemical actions and composition, we are wont to consider the paraffines as mixtures of the higher members of the marsh gas series, C_n+H_{n+2}. (Marsh gas, CH_4, the first member of the series, is also called *methane*, and the other members, C_2H_6, C_3H_8, C_4H_{10}, etc., are called homologues of methane.) On comparing the observations made from time to time on the paraffines with recent investigations made on synthetic homologues of methane, this hypothesis of their identity gains much additional strength. In order to settle the question more definitely, Lützelschwab has carefully studied one of the commercial paraffines, which melted between 52° and 54° C. (125½° to 129° Fahr.), but began to soften at a lower temperature. He submitted it to systematic recrystallization from alcohol and ether, combined with fractional distillation, first in copper retorts, then in glass vessels heated in metal baths and under reduced pressure to prevent any change in composition from the action of heat. From the lower boiling portion of this paraffine we separated the normal hydrocarbons, $C_{22}H_{46}$ and $C_{24}H_{50}$, previously prepared by me, and also the two following homologues, $C_{26}H_{54}$ and $C_{28}H_{58}$, which were readily and easily identified as "normal" substances, calculating their properties by interpolation in the table that I had previously given for this series. The results of this investigation, as compared with my previous experiments, can be seen in the following tables:

I. ISOLATED FROM COMMERCIAL PARAFFINE.

	$C_{22}H_{46}$.	$C_{24}H_{50}$.	$C_{26}H_{54}$.	$C_{28}H_{58}$.
Melting point	43° or 44°	50° or 51°	55½° or 56°	60° or 61°
Specific gravity	0·7778	0·7786	0·7792	0·7793
Boiling point	234° to 236°	243° to 245°	261° to 263°	279° to 281°

II. ARTIFICIAL NORMAL PARAFFINES.

	$C_{22}H_{46}$.	$C_{24}H_{50}$.	$C_{26}H_{54}$.	$C_{28}H_{58}$.
Melting point	44·4°	51·1°	57°	61½°
Specific gravity	0·7781	0·7786	0·7790	0·7796
Boiling point	204½°	243°	261°	279°

[Degrees given in table are Centigrade, and boiling points were measured under a pressure of 15 mm., or about one-half inch.]

The perfect coincidence of the properties of these substances throughout both series, establishes their identity with great certainty. These four preparations obtained by us amounted to about 8 or 12 per cent each, and together made up about 40 per cent of the whole material used. Traces of homologues melting at higher and at lower temperatures were noticed. The larger intermediate portion of course still contained a considerable quantity of the above hydrocarbons, and perhaps others of the uneven members. Absolute proof of this would be tedious and offers no special interest, and there is still less need, at present, for such a study of the lower melting, and ordinary liquid paraffines, unless it should be necessary to prepare them in a pure state on a large scale for special uses.

All the lower members of the series obtained as secondary products from the action of strong heat on the higher normal paraffines, when freed from adherent olefines, are of course themselves normal. For scientific purposes the artificial products deserve the preference because they alone are perfectly pure paraffines.

On the other hand, the important question presents itself of how commercial paraffine is made from brown coal, and indirectly what is the best way to make it from this source.

From the foregoing it will be seen that the paraffines are mixtures of no less complicated nature than has been generally supposed.

The proof that has been adduced of the identity of their constituents recalls the fact that was recently mentioned by me also, that the higher members of the natural fatty acids, from capric to stearic acid, are all normal. The inevitable explanation of what at first seems strange, is that normal substances are more permanent than their isomers, and hence the greater tendency to their production.

Dr. Bolton on Chemical Symbols.

At a recent meeting of the New York Academy of Sciences, Prof. H. Carrington Bolton, of Trinity College, gave an interesting sketch of the history of chemical symbols from early times to the present day. Until less than a century ago letters were rarely used, and the hieroglyphics assumed many curious and grotesque forms, which served rather to conceal than elucidate the subject treated of. Dr. Bolton exhibited several rare old books containing lists of symbols, some of which he had transferred to large sheets of paper and hung about the room. One peculiarity of ancient alchemistic nomenclature was personification, using names of persons and animals for metals or compounds; thus, gold and silver were called the king and queen, antimony the wolf, iron was Mars, and sal ammoniac was the eagle, while the name of Mercury was given not merely to the fleet footed god, but also to quicksilver and to a planet. The well known symbol of the sun (a toothed wheel) was used for gold, that of the moon for silver, etc. But in addition to these, many substances had more symbols than they had names, nearly 90 being used for sodium chloride.

Dr. Bolton has attempted the classification of alchemistic symbols, making five groups. In one class the first letter or letters were used; in another they were pictorial, as waved lines for water, etc.; in another they were symbolic, like that of the sun for gold, of the moon for silver, etc.; in the fourth they were purely arbitrary, and no connection could be detected between sign and signification. In the fifth class he placed mixed symbols, as when a inverted delta or triangle combined with R is used for aqua regia, delta and F for aqua fortis, etc.

The various attempts to establish a scientific set of symbols were described, and their faults noticed, until, finally, Dalton, in 1787, hit upon the present simple and expressive code, which is hardly capable of further improvement.

On the Ammonia in the Air and in Rain, etc., at Great Heights.

It has long been known that the small traces of ammonia in the air are carried down to the soil by meteoric precipitates, and Schlösing has shown that it is fixed directly by the oxidizing action of the soil and of the leaves. In connection with these investigations he also called attention to the sea as the great reservoir which supplied the air with ammonia. He devised an ingenious method, which enabled him to operate on large quantities of air, and with it he examined the currents of air circulating near the ground.

Recently Muntz and Auber (*Comptes Rendus*, xcv., 788) have been estimating the amount of ammonia in the air on the top of Pic du Midi, which is 2,877 meters (nearly two miles) above the level of the sea. The tests were made morning and evening in a laboratory especially erected for the purpose. The average was 1·35 milligrammes in 100 cubic meters. These numbers, although so extremely small, do not differ perceptibly from those obtained at the earth's surface.

They also made 13 analyses of rain, 7 of snow, and 5 of fog. In rain water they found between 0·34 and 0·80 milligramme per liter, in fog 0·19 to 0·64 milligramme, and in snow 0·06 to 0·14 milligramme of ammonia per liter.

Fulfilling the Covenants in a Lease.

The absurdity of some of the "covenants" in leases is sufficiently illustrated by the advertisement of an out-going tenant, who advertises for five hundred rats and about ten times that number of weeds, he having covenanted to leave the premises in the same state as he found them. The rats, adds the humorous advertiser, must be able-bodied and no cripples. The advertisement is a practical, albeit humorous, commentary on many of the usual covenants contained in leases. The tendency of modern legislation, and of modern legal procedure, says the *Building Times* (London), is to prune the redundancy which once was the delight of the legal profession and the despair of litigants. The covenants were mostly of a sort which no person could keep altogether; and in effect they were and are generally broken. The advertisement we have alluded to is the *reductio ad absurdum;* obsolete covenants and provisos are, we trust, in a fair way to be consigned to the same place as many other legal absurdities.

Artificial Coffee.

At the present low price of coffee it would hardly seem the best time to bring out a new substitute but a M. Sornani, of Pavia, in the *Ann. di Chim. appl. Farm. et Med.*, announces that he has discovered quite a new and serious adulteration of coffee, which is being practiced by the manufacture of artificial berries. These berries are composed of the meal of beans and acorns, with chicory and some quartz powder to bring the mixture to the requisite specific gravity. A dough is made of these ingredients, which is cut by a special machine into the shape of coffee berries, and after drying has exactly their color. Sornani says he has found as much as 50 per cent of these artificial berries mixed with the genuine. On roasting they take just the same color as the genuine, but they are discovered by soaking in water, when the false berries soon fall to pieces.

THE Belgian Academy of Sciences offers a prize of $600 for the best treatise on the destruction of fishes by the pollution of rivers. Those competing for the prize must send in their work before October, 1885.

Treatment for Snake Bites and Hydrophobia.

At a recent meeting of the Lower Rhenish Philosophical and Medical Association, held at Bonn, Professor Binz described an interesting series of experiments carried on under his direction, with a view of testing various antidotes to the poison of serpents. He remarked that numerous specifics are heard of among the native population of India, which, as a rule, are found to be of themselves inoperative. Professor Binz stated his opinion that when a real Indian poisonous snake has bitten a person in the usual manner, spirits can only serve to prevent or to alleviate the spasms of suffocation which are induced by the action of the poison on the respiratory nerves. Atropine and other specifics against imminent results of an analogous character, caused by narcotic influences, have been found ineffective against this deadly virus. The most favorable tests made were with chloride of lime, a filtered solution of which was injected into the same place where the fatal virus had previously been introduced. In seventeen trials made in succession, the poisoned animal survived without the slightest disturbance of its healthy condition. In five succeeding experiments, when a relatively insufficient dose of the antidote was administered, or when animals suffering from disease were operated upon, the chloride of lime served only to retard the fatal effects of the poison. The suggestion was made by Professor Binz that the adoption of this treatment in cases of the bites of dogs suffering from rabies might possibly be attended with favorable results, inasmuch as chloride of lime has been shown to have much greater power than any of the caustic substances now usually applied to dog bites, which have been proved to be scarcely, if at all, effective against the consequences of snake bites.—*Lancet.*

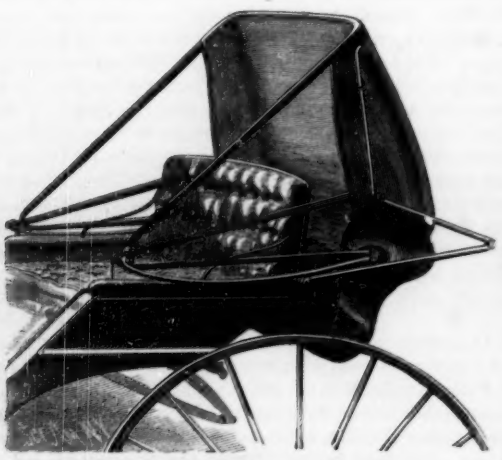
Ammoniacal Liquor as a Fertilizer.

The *Journal des Usines a Gaz*, on the subject of the use of ammoniacal liquor as a manure, states that it was so highly appreciated by the Belgian agriculturists that the entire production of the gas works at Malines was bought up in the crude state at the rate of 1 fr. 25 c. per hectoliter (say $1 per 100 gallons) on the spot. Upon newly cleared ground the liquor was used just as it left the works; but for irrigation purposes it was diluted with three or four times its bulk of water. The effect produced on the soil by the use of the liquor is stated to be exactly the same as when stable dung (which is usually considered to be the best kind of manure) is employed. The writer found that in rainy seasons the liquor might be used in an undiluted condition; and when spread over the ground in the proportion of about 1,500 gallons to the acre, a perfect dressing was obtained. In dry weather, however, the liquor had to be diluted with an equal bulk of water, and a double quantity of the mixture used, to produce similar results. But even in this condition it was found to possess the same value for agricultural purposes as stable manure.

BUGGY BOW SPRING.

The engraving shows a device to be attached to the rear bow of a buggy top for the purpose of guarding against the breaking of the bow when the top is suddenly thrown back, and to carry the weight of the top when down.

The device consists of a curved spring of steel or other suitable material, pivoted at its lower end on the bolt, which forms the pivot on which the bows are hinged, and fastened at its upper end to the rear bow by means of a clip. The spring is a curve, of which the rear bow is the chord, their only points of contact being at the ends of the spring, and the curve lies wholly on the rear side of the bow.



McELHANEY'S BUGGY BOW SPRING.

When the top is thrown back, instead of the bow striking the pivot of the brace, the interposed spring strikes on the pivot and receives the force of the blow. The bows are rigid, and it frequently happens that when the top is thrown back suddenly the force of the fall breaks the bow, whereas when the device shown is used, the yielding spring acts as a cushion, and breakage is impossible. When the top is down the weight is borne by the spring, which rests on the bolt, and forms a yielding support, taking off the strain caused by any sudden jar from inequalities in the roadway passed over.

This useful invention has been patented by Mr. Samuel McElhaney, of Polo, Ill.

IMPROVED HAT HOLDER.

We give an engraving of a very simple, inexpensive, and efficient holder to be applied to the backs of opera seats, church pews, seats of public halls, to the sides of railroad coaches, and to be used wherever a thing of this kind is applicable. It is formed of Bessemer steel wire bent into the form of the treble clef in music, the straight portion being secured to the back of the seat by suitable fastenings, which permit of swinging it out for use or out of the way and against the back of the seat when not in use. The upper loop of the holder is capable of springing sufficiently to receive the brim of any hat, and the lower coil will receive an umbrella or cane, as shown in the engraving. The wire is in a single piece, and where it crosses itself is left free to move, so as

LINDSEY'S HAT HOLDER FOR OPERA SEATS, ETC.

to accommodate itself to the object to be held by it. The lower end of the wire is provided with a hook which may be brought into engagement with the adjacent loop. It may be provided with a simple round knob to give it a finish, and to prevent the clothing from catching in it. These holders are nickel plated and nicely finished, and an ornament to the seat rather than otherwise. This improvement is being put in theaters of several large cities, and it is now regularly manufactured in Baltimore.

This useful invention has been patented by Mr. George W. Lindsey, of Baltimore, Md. (P. O. Box 797).

Basic Furnace Linings.

It appears, from a recent paper issued by Junghaug and Uelsmann, in *Dingler's Polytechnisches Journal*, that soda and potash carbonates are used instead of the corresponding chlorides of those metals, and that the durability of the lining is said to be increased by the addition of cryolite. The following modification of the usual method of preparing the lining has been found to answer admirably: The raw or calcined masses of lime, dolomite, or magnesite are ground and mixed with the flux; the mixture is then burnt to dust and worked up into bricks, the dust being rendered plastic with tar treated with 3 per cent of flux. When the flux is made up of alkaline carbonates, ground calcined phosphate or bone black, with the addition of a few per cent of the alkaline carbonates, are used in the preparation of basic bricks, muffles, etc. André states that the basic masses are to be burnt at a high temperature, then pounded and ground, and the powder thus obtained is formed into bricks by the addition of freshly prepared lime sulphate. Two per cent of the lime sulphate suffices to form a plastic material. Borsig proposes to mix dolomitic limestone, either in a crude, calcined, or finely divided form, with from 2 to 2·5 per cent of crude boracic acid, or 3 per cent of fused and pounded borax. The mixture is used in a dry or wet condition for lining furnaces or for the preparation of bricks.

According to the Society of Mines of Hörde, and the Rhenish Steel Works at Ruhrort, limestone, free from magnesia, containing not more than from 15 to 20 per cent of silicic acid, alumina, iron oxide, and manganese oxide may be used for the preparation of basic linings. The quantity of iron oxide present should not exceed 6 per cent. It was, further, found that phosphorus can be got away in the slag without the after blow, by the use of fluor spar equivalent to one-tenth part of the tribasic lime phosphate formed. Instead of fluor spar, alkalies, alkaline earths, or cryolite may be used. The dephosphorization is also effected by blowing air into a reverberatory furnace having a basic hearth. Immediately before the introduction of the metal into the converter lined with basic bricks, it is recommended to add lime or a mixture of eight parts of lime and one of ferric oxide. The mass is heated and air blown in for from six to ten minutes, when the converter is emptied, and the metal treated with a mixture of from two to three parts of lime and one part of ferric oxide free from silicic acid. The quantity of flux in the first blowing amounts to twice the weight of silicium and phosphorus contained in the original charge, while the quantity used in the second operation depends on the durability of the converter. The object of the addition of the second flux is to obtain a slag containing more than 36 per cent of lime and magnesia. The basic flux may be replaced partially or wholly by manganese ores, cryolite, fluor spar, and caustic or carbonated alkalies, while phosphorite or bone-black, mixed with clay or asphalt, is used as a lining. After the decarburation of the iron bath the oxidation of the remaining phosphorus is effected by the introduction of oxidizing agents, as ferric and manganic oxides, into the iron. This operation takes the place of the after blow.

Purifying Carbon Disulphide.

Palmieri recommends the following practical method of purifying carbon disulphide on a large scale. After removing the water that usually covers the commercial article, 2 or 3 per cent of dehydrated copper sulphate are added and then shaken. After the blackened sulphate settles and no more odor of sulphydric acid is observed, it is filtered or decanted.

To get it absolutely pure the carbon disulphide is rectified over anhydrous copper sulphate, when it loses all unpleasant odor. To preserve it odorless it must be left in contact with copper sulphate, which can be regenerated by igniting, treating with sulphuric acid, and igniting it again.—*J. Prac. Chem.*

THE NORDENFELT GUN.

This gun has been adopted by the British Admiralty. The report of trials proved that the hardened steel bullet of 7¼ ounces weight, at a range of 300 yards, penetrated, at an angle of 45 deg., the side and boiler of a torpedo boat, as represented by a $\frac{1}{16}$ inch steel plate 18 inches in front of a second steel plate $\frac{1}{8}$ inch thick. When firing directly end on at a torpedo boat, the bullet penetrated the steel bow plate $\frac{1}{16}$ inch thick, at an angle of 10 deg., and four bulkheads at right angles; striking the boiler, the bullet then indented the half inch steel plate representing it, to a depth of half an inch. At a subsequent trial at Portsmouth, under similar conditions, the plate was perforated altogether.

The accuracy was found most satisfactory, the mean deviation at 300 yards, of 10 rounds fired slowly, being 5·6 inches, while the mean deviation of 24 rounds fired in rapid volleys was 18·3 inches.

The rapidity of fire ashore at one trial was 108 *shots* in thirty seconds. During another the gun was fired at sea from H. M. S. Medway when running at a speed of 9 knots. In this case the target was the bow of a model torpedo boat; during a run of 1 min. 45 sec. and over a range of from 500 yards to 100 yards, 115 hits were made out of 135 shots fired, equal to 65 hits per minute. In a subsequent trial at Spithead in July, 1880, the gun was placed on board H. M. S. Iris. On this occasion two runs were made at a speed of 17·2 knots, directly against the bow of a torpedo boat model. Firing from 700 yards distance until close up, both runs occupying 2 min. 19 secs., 110 shots hit the target out of 213 rounds fired, so that even at this high speed 48 hits per minute were recorded. Running past the torpedo boat at 200 yards range and at a speed of 17 knots, 58 rounds were fired in 22 seconds, and of these, 38 shots hit the torpedo boat, being at the rate of 103 hits per minute.

The four barrel gun is illustrated by the perspective view.

THE NORDENFELT GUN.

The gun consists of a rectangular framework of wrought iron, the sides of which are connected by three plates or transoms. The four barrels are placed side by side in the frame, their muzzle ends passing through the front cross piece, while the breech ends are screwed into the middle transom.

In rear of the middle cross piece is the action block, which is capable of movement backward and forward. In front of this action block are four breech plugs, corresponding to the barrels. These are of steel pierced with a channel, in which a firing pin or striker moves freely, and they are furnished with an extractor on the right side. Behind each plunger is a hammer, with a projecting tenon, and behind the hammer a strong spiral spring.

THE ARCHER FISH.

The archer fish (*Toxotes jaculator*) belongs to a group or sub-family of the scale-finned fishes (*Squamipinnes*), so called because the "vertical fins are more or less densely covered with small scales." The principal characteristic of this fish is the elongated lower jaw. The inhabitants of Java, its native island, keep these fish in their houses as pets. They are sometimes twenty centimeters in length. The coloring of the upper part of the fish is greenish-gray, the under part silvery; there are four short, wide bands across the back, dark brown, with a shade of green.

With few exceptions, all of the scale-finned fishes are found in the upper stratum of the water and near the shore; some of them descend into the ocean, and others occasionally wander out into the sea, following ships for their refuse, or chasing other prey. Most of them, especially the beautifully colored species, belonging to this family, are found, as a rule, in the vicinity of reefs, or above shallow places, playing in the sunshine. Their beauty is very much heightened by motion.

Heuglin says that in the Red Sea they are commonly observed in the deep chasms or well-like depressions between the coral reefs, where the water is always clear and quiet, although there may be a high sea outside.

When a ship anchors in a dark night between the reefs, the presence of these fish may be perceived by their phosphorescence.

They may be observed, often at a considerable depth, faintly glowing spots; suddenly they disperse like scattering sparks, move slowly to and fro, gather together in groups, and separate again.

Nearly all the fishes of this family are carnivorous, feeding upon small medusæ, coral insects, etc These fish, Heuglin says, play around the coral branches in the same manner as birds hover around trees upon the land.

In crowds they stand still for a few minutes before a branch of a coral, suddenly dart forward, bite at the coral insects on the branches, and hasten as if inspired by a spirit to another place, to go through the same play, and begin again the same chase.

As soon as the archer fish sees a fly or any other insect sitting upon a plant hanging over the water, it approaches to within about one or one and a half meters, and spurts from its mouth a drop of water, so violently and with such accuracy that it seldom misses its prey.

It has this habit even in captivity, and the Japanese make a household pet of it. They keep the fish in water basins, and place in the middle of the vessel a stick, sometimes reaching out over the water sixty centimeters. In the stick wooden pins are fixed, and insects are fastened upon them. Soon after this is done, the fish swims around the stick, comes up to the surface of the water, raises its eyes toward the surprised insect, suddenly spurts a drop of water upon it, throws it down, and swallows it if its shot is successful; if not, it swims around the stick and tries again. The certainty with which they throw this jet of water upon their victims is wonderful.

In order to observe this, Hommel thrust a needle through a fly and fastened it to the stick. Without intermission, rapidly, and in regular order, all of his fish attempted to throw the fly down, without once missing their aim as they shot the drops of water upon it.

Insects appear to be the most natural food for this species, and seem to be preferred to every other kind of food. —*From Thierleben, by A. E. Brehm.*

THE ARCHER FISH.

Wisdom of Plants.

As an example of the curious property of plants in selecting from a soil only those materials proper for their nourishment, the ice plant, which is found abundantly on the Mediterranean coasts, is one of the most striking. It has lately formed the subject of some experiments by M. Mangon, who has cultivated it for many years. Its popular name is derived from the little vesicles filled with water which cover its stem, and have much the appearance of frozen dew-drops.

Analysis shows that it sucks up from the soil a large quantity of soda, potash, and other alkaline salts; indeed, it may be said that the plant represents a solution of alkaline salts held together by a vegetable tissue only, weighing two per cent of its mass. M. Mangon believes that the plant might be useful if planted on unproductive soils where such salts are in excess, thereby rendering the ground suitable for ordinary cultivation.

Carbonic Oxide in Common Furnaces.

According to Mr. J. Lowthian Bell, every furnace wherein a high temperature is attained is virtually a carbonic oxide gas furnace. He shows that carbonic acid, the product of the perfect combination of carbon and oxygen, cannot exist at a high temperature, in consequence of dissociation taking place. Therefore, if a great heat is desired from solid fuel, it is impossible to avoid the waste represented by the formation of carbonic oxide at some region above the fuel, and where there is usually no provision for using it. It has long been known that carbonic acid breaks up at high temperatures; but Mr. Bell has shown that the same effect is produced at comparatively moderate temperatures—a view in which he is supported by M. Berthelot. He mentions the well known phenomenon of the carbonic oxide flame just above an ordinary open coke fire; and says that this is not merely due to the fact that the gas can only inflame in contact with fresh air, but also that it could not burn in the hot fire below. Thus every furnace is a carbonic oxide generator; the only difference between those which avowedly produce gas and those in which the work is done by the primary burning of solid fuel being that the former turn to good account what the latter produce to waste. The lesson to be drawn from these observations is that the only way to burn coal or coke to advantage is to first convert it into carbonic oxide, and afterward burn every atom thereof in the right place. Unless this sequence of operations is followed by design, it will assuredly be observed by nature. According to this view, the gas furnace is less revolutionary in principle than has been supposed; it is simply a method of regulating and rendering profitable a natural and otherwise wasteful process.

A FRENCH surgeon says, that on chloroforming some mice and lifting them by their tails, they tried to bite, but on laying them again in a horizontal position, they resumed insensibility. Acting on this hint, when a patient showed signs of collapse under a dose of chloroform, he dropped the patient's head over the bedside and raised the feet quite high. The patient at once became conscious; when laid straight on the bed he became insensible again, and a return to lowering the head and raising the feet for ten minutes was required to counteract the chloroform. It is thought that by this treatment anæsthetics may be used with great safety.

Indigestion and Disease.

Dr. Henry Reynolds has an article in the *Phrenological Journal* on indigestion which seems to define the nature and symptoms of the complaint very closely.

Many suffering from dyspepsia will find their own feelings described in the following extracts, taken from Dr. Reynolds' paper, and we hope some will derive benefit from his hints:

The important relation of indigestion to many diseases which people suffer is not sufficiently realized. Difficulty in breathing, occurring spontaneously, or on slight exertion, may be caused by indigestion.

Indigestion causes alterations in the general nutrition of the body, which are manifested in various ways, among which are the following: Anæmia, or a depraved state of the blood, involving a deficiency of the red globules of the blood, and causing persons thus affected to be unnaturally pale, especially about the lips; decay of the teeth; grayness of the hair; excessive liability to inflammation, from slight causes, of the mucous membranes, especially the eyes and throat; to which may be added, in cases of those predisposed to such affections, liability to gout and rheumatism, and affections of the lungs or kidneys. Consumption has frequently been regarded as due in many cases to long continued derangement of the digestion, whereby the general nutrition of the system has become impaired.

The inflammation of the mucous membrane of the throat, known as "clergyman's sore throat," is a product of indigestion, and the removal of the cause by the adoption of a suitable dietary, exercise in the open air, and observance of the laws of health generally will be the best treatment for it.

Indigestion is the cause of various alterations in the skin manifested by general coldness or chilliness, especially of the extremities, by changes in its color or texture, which may be earthy or sallow in tint, or dry and coarse, and by various eruptions, among which are the well known eczema, acne, impetigo, and nettle rash. Most of the cases of skin disease affecting children are best treated by attention to the diet, making the diet easily digestible, and sufficiently limited to insure complete digestion.

The causes of indigestion may be due to the food or condition of the stomach. The food may be defective in quality. There may be excess or deficiency of the normal ingredients, saccharine, starchy, albuminous, or fatty, or some of the naturally indigestible materials which form a part of all food. The food may be introduced in an indigestible form on account of defects in the cooking of it, or imperfect mastication, or from its having undergone putrefaction or fermentation, which arrests the functions of the stomach. Imperfect mastication of food is a very common cause of indigestion among Americans.

Eating too much is probably the most common of all causes of indigestion. The secretion of the gastric juice in the stomach seems to be proportioned to the amount of material required for the nourishment of the system. Food taken in excess of this amount acts as a foreign substance undergoing fermentation and putrefaction, and occasioning much disturbance in the system.

Much may be done for the cure of indigestion by eating very abstemiously of suitable food, thoroughly masticated, taking exercise in the open air, breathing pure air, and observing the laws of health generally. The amount of food should be reduced until the quantity is reached which the stomach can digest without evincing any symptoms of indigestion.

The Marseilles Tea Trade.

Within the last few years there has been a singular development of the tea trade at the port of Marseilles. In 1850 the arrivals did not exceed 12,000 kilogrammes, most of which came from the warehouses of the Hanseatic towns and from London. Ten years later the direct relations with the East caused a great movement of tea to Marseilles, the annual imports being 229,114 kilogrammes, of which 223,813 came directly from China. Since then the trade has been very greatly on the increase, the quantity for 1881 being 3,198,430 kilogrammes, of which 2,878,675 were from China. Of this quantity 52,593 kilogrammes were for home consumption, the duty upon which amounted to 111,471 f. The imports of tea for the whole of the French ports were 3,572,268 kilogrammes.

Steam Plowing in Scotland and the United States.

At the recent session in Chicago of the National Agricultural Convention, a variety of other interesting topics were discussed, including that of steam plowing. Among those present was Mr. George Greig, of Scotland, whose long experience with steam plows enabled him to give some very practical and useful information. He gave a description of the great farm of the Duke of Sutherland, in the counties of Ross and Sutherland, comprising one million four hundred thousand acres, and of the efforts of the Duke to accomplish the reclamation of this land, heretofore, a vast waste, by the use of steam power.

The land is laid out in forty acre fields, with roads for the cultivating engines at each side. The steam cultivator consists of two engines and the plow, which is intended to travel between them. The engines are constructed very much in the same way as the ordinary steam cultivating engines of this class. Each engine is fitted with a drum upon which the rope which hauls the implement is coiled, and they work alternately, pulling the plow backward and forward. The plow here is the great object of interest. It if entirely of a novel character, and has cost, in its development to its present perfection, not less than £10,000 in experiments. The result of its action in the soil is very much like that of ordinary trenching by manual labor. It is provided to take two furrows about twenty inches broad. The first one cuts off the vegetable matter and throws it into the bottom of the trench, while the second one takes up the subsoil from below and places it upon the top of the vegetable matter, the depth of the two furrows being from two and one-half to three feet. The first plow is provided with a discolter, which is set to work at a lower level than the share, and thus carries the first plow over any bowlder with which it might otherwise get engaged. The second plow is hung on the end of a strong lever, which is held down with a given tension from the rope, so as to engage the stones passed over by the first plow and drag them out. Small stones are thrown to the surface, and large ones are dragged up and left to be hauled out by the wire rope on its return journey. The cost of trenching land by this system to a depth of two and one-half to three feet has been found, with the latest improvements, not to exceed £4 per imperial acre, and this includes the payment of men in the trench throwing up the stones, which fall back into the furrow after the plow has passed. To do this trenching entirely by manual labor, to leave it in a condition as efficient as the steam operation, would cost at the present time not less than £25 to £30 an acre.

The next operation in connection with the reclamation is the clearing of the stones, fifty tons to the acre. The device was a steam sledge which carries from four to five tons of stone. This sledge has been so constructed that when it reaches the end of a field with its load, and the motion is reversed, it turns a somersault of its own accord and leaves the load behind it, returning to be refilled. This sledge was not only found to be a very economical way of carting off the stones, but a great benefit in consolidating and leveling the surface of the land on its passage.

The next operation is the liming of the land, at the rate of from four to five tons an acre. The lime is brought from England, a distance by sea of five hundred miles, then carried by railway twenty miles. A small engine of four horse power and of three tons weight answers the purposes of carting, reaping, rolling, and driving. With it the lime is taken from the railway station to the fields and deposited at the end of each field in large heaps, to be again drawn into lines through the fields with the wire rope and larger engines, using the stone sledge as the carting machine. The sledge has a capacity for six tons, and when it arrives at the part of the field where the lime is required, it tips it out in the same manner as has been described with the stones.

The fencing is made in the usual way with stones taken from the land, and where there are no stones iron fencing of a novel description has been devised in order that it may be folded down on the ground when necessary, so as to allow the steam plow ropes or cartages to pass over it at any point. The standards, which are fixed in stone, are hinged at the bottom, so that when the bolt which fastens the stay is taken out the fence falls over. This fence has been found to be great economy where large snow storms occur; through being laid down all winter and lifted up in spring, the snow in this way cannot injure it.

The execution of the under drainage on the reclaimed lands has given rise to greater difficulty than the other operations, in as far as no direct effort was made to accomplish this by steam power. Until lately there was no known implement that would have coped successfully with the bowlders which are to be met with in a drain four feet and a half deep. I feel sure, however, that in the future the plow which I have described for trenching, with very slight modification, will successfully cut out drainage to a depth not exceeding five feet, and at a price not exceeding one-tenth part the cost of manual labor.

In the view of putting it under crops, the surface cultivation of the land has also been undertaken by steam, and for this purpose a novel implement was produced in the shape of a machine which works very much on the principle of the American disk harrow. This implement runs over the land at a rate of six miles an hour, and pulverizes it to an extent to make a seed bed for the smallest and finest seeds.

The primary object of the reclamations has been fully realized, in as far as the farms that have been operated upon are now self-sustaining. Referring to the possibility of making tanks upon land for the purpose of retaining water for the use of stock, I will mention a very interesting incident. The engines which have been introduced by the Duke of Sutherland have been used in New Zealand for the purpose of making tanks for storing water. A machine has been constructed with something of the character of a scoop. This scoop is arranged upon wheels under the engine and controlled by the man who sits upon it. The engine is placed upon that end of the ground intended to be excavated, and this machine runs down and fills itself, and is run up again and is emptied by the action of one man. The success of the first machine taken to New Zealand was such that a large demand sprang up for them, and great tracts of country in Australia, which formerly could not be grazed, are now being stocked with sheep.

The cost of the entire set of machinery for ditching by steam, including two engines of fourteen horse power, with a ditcher, would come to about $10,000.

The steam cultivating engines are from six to twenty horse power. These small engines are in use in many portions of Scotland, where the fields do not exceed ten acres in extent.

The expense of plowing an acre of ordinary land in Scotland with horses, common plow, and common attendants I estimate at $3 per acre.

Mr. Grinnell (of Iowa): Since we have got these broad Clydesdale horses and the French horses—"necks clothed with thunder," and all that sort of thing—and our farmer boys to ride the plow, we plow for seventy-five cents an acre, and there are plenty of people who want the job at that rate. That being the case, do you think we can be seduced into introducing steam plows when we have Clydesdale horses?

Mr. Greig: I am not prepared to recommend the application of steam plowing when land can be plowed for less than one dollar an acre.

For ordinary surface cultivation I am not prepared to tell you that steam plows have supplanted horses or mules; but when you want very deep cultivation, such as is required for grading roads, sugar cane crops, and that sort of thing, I am quite satisfied that steam cultivation will compete with horses very successfully. And one of the advantages of steam cultivation is, that you get a much better kind of cultivation than you can with horses; you plow deeper and it gives you a mixture of soils, and you get much better results than could be gained by simply turning a furrow. We can run a cultivator at the rate of six miles an hour, but we don't profess to run a plow at a high speed. I will mention a very interesting thing that has only now come to light. Heretofore we have been restricted in the breadth of the implement. We found we could only cut a certain number of furrows. Our plowing machine has always been under the power of the engine. If we could cut the number of furrows the engine could plow, we would be able to double the work and reduce the cost one-half. We have now hit upon a plan by which we can work more than one implement on the same road; and I have no doubt that in the course of two or three years you will find that steam plows will be coming into use in America. With a couple of engines and a steam plow you can turn from twenty to thirty acres of prairie land in a day, and you would consider that a good day's work. I am quite satisfied, from what I have heard of the prairie land and the manner in which you plow, that thirty or forty acres will be within the power of the engine under this new system.

Mr. Grinnell: The preparation of the soil costs $16, and liming $5. That makes about $21 or $22 an acre. The question is, then, how in the world you can induce anybody to stay in Scotland, where it costs for the preparation of the soil $21 or $22 an acre—what persuasion is used, what forcible argument or entreaty, to keep them from leaving the country? I don't understand it.

Mr. Greig: I must tell the gentleman, in answer to his question, that I have been standing in Scotland as if on a hot brick. It was only circumstances I could not overcome which prevented my being in America years ago.

Mr. Charles H. Wood (of Chicago): This subject of steam ditching is one with which I am, so to speak, loaded to the muzzle, and I am going to answer some of the questions the gentleman from Iowa suggests. He was comparing the cost of plowing in Scotland with the cost of plowing here in America, which he places at 75 cents an acre. It is only fair to remark that the work required to do the plowing that is done in England and Scotland would cost, with our implements and our experience, and the same expense of feeding and wages, probably $1.50 to $2.00 an acre. They do it more thoroughly, and the soil is more difficult to work. In regard to the applicability of the English steam plow to American uses, there are parties who have faith in its success here. Some have been introduced in the Red River region, and one or two in other places. Several years ago—fifteen or twenty—one or two sets of English plowing tackle were brought into Illinois, and, I think, all of them have been abandoned, except one which has been operated on a sugar plantation south of New Orleans by Mr. Lawrence. It has been demonstrated in that region, by actual results, that the yield of sugar per acre has been increased from ten to fifteen hundred pounds under steam plowing where the ordinary crop without it was about 1,000 or 1,200, which makes an increase of forty or fifty per cent. That is not a fair gauge of what it would be worth in our prairie country, because down there the great advantage is that they can do the work more thoroughly and plow deeper than they can with horses and they find that deep plowing greatly enhances the quantity produced per acre. Another thing, the climate there is such that they cannot get the same power out of horses practically that we can, and it costs more to feed their horses. I have given this matter a good deal of study, and have endeavored to learn all I could in regard to what has been done in England and Scotland, and I have learned something further from the gentleman's remarks this afternoon. But what I have learned convinces me that the English plowing apparatus, the cable system, a wire rope steam plow, where the engine is stationed at each side of the field, never can be a practical success in a general way in this country; but a steam plow for this country must be a traveling locomotive engine—that has been moderately successful. There have been experiments in that direction which show that it is possible to do it, but it has not yet been found practical to do it. The steam plow was tried here in Chicago, and it worked pretty well on dry, hard ground, plowing at the rate of three acres an hour. I think there were eight plows; they made a track six feet in diameter, and everybody was convinced then that it was the coming way for plowing. The next year, I think it was, it was tried at the agricultural exposition at Freeport, and there they found some soft, wet ground, and when they got into that field there was no friction to hold the drum against the ground, and the drum gave way, and the result was the plow stopped. They put on more steam and turned the plow faster, but it wouldn't work. At Decatur, about the same results followed, and one or two more experiments have been made to bring out a locomotive steam plow.

It is hardly worth while to go into details in regard to them all; but it is evident, from the experiments and failures of the past, that the direction in which further efforts should be made is by some means of putting snow shoes on the engine. I will further illustrate what I mean in this way: I suppose most every farmer here has heard of, if not tried, the experiment of wooden clogs upon horses' feet, for the purpose of hauling a load of hay on soft meadow ground. It is a matter of common practice with some farmers, where they have soft meadow, in order to haul hay off of it, to put on the horses' feet wooden clogs, and they found where a team could hardly get over the ground without the clogs they could do so without any trouble and haul a load with the clogs. I suppose, in connection with that, they had broad tires on the wheels. If a man wants to travel over snow, after a snowstorm, he puts on snow shoes. This distributes his weight over a larger surface, and he succeeds in walking on top of the snow, where otherwise he would sink before getting out of sight of his starting point. There are a great many men working at the problem of a traveling steam plow; some are wasting their efforts trying to get *something* very light—something that don't weigh anything. Now, it is evident that an engine, to have force, must have weight; it is evident that a pony never can pull the load that a heavy Clydesdale horse can; it is evident that a heavy Clydesdale horse must have greater width to support him on soft ground than a pony. If you want to have a good engine of twenty tons weight, you must have broad feet for it to rest on. Now, if some practical means can be brought out to distribute that heavy weight over a broad surface and a flat surface of ground, it will be practical to make a traveling locomotive steam plow with the capacity of going over soft ground without miring, and you will have something that can be used wherever desired. You can use heavier implements than you do now; you can use a kind of implement that would not be safe for a moment now, or at all practicable. I believe, Mr. President, that the subject of steam tillage is one of the most important, and will soon claim as much attention as any other subject which can be brought before this convention; and I think, in connection with your proposed exhibition next year, it would be a very desirable thing, and of great importance to the general interests of the agricultural classes, that encouragement be offered in the way of a premium for something of this kind.

We may add as a postscript to the foregoing that the steam plow has, within the past few weeks, been set to work in California, with much success. A recent number of the Stockton *Independent* gives this report:

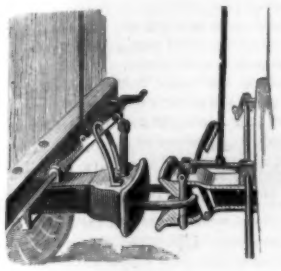
"I saw the steam plow work yesterday. Engines, 2; distance apart, 460 yards; width of land plowed at each passage, 4 feet; number of plows used, 8; 4 used at a time; there should be 5, making 10 in all, but 2 are being tempered; time of cutting a furrow, from 4 to 5 minutes; power of engines each, 40 horse; character of land, tough, black sod, salt grass growing; depth of furrow, 6 inches; every part of the machinery working well; cost of fuel, $5 per day for both engines; capacity, from 40 to 60 acres per day in sandy soil. The writer is of the opinion that, with very few alterations on the plows, the machines will prove an immense success, and will supply a long needed want for plowing land in California. Land plowed by this machine will produce at least one-fourth more crop for a period of six or seven years than by the ordinary plowing in use in this State."

ACCORDING to the *Milling World*, sackcloth or canvas can be made perfectly impervious to moisture equal to leather by steeping it in a decoction of one pound of oak bark with fourteen pounds of boiling water. The cloth has to soak twenty-four hours, when it is taken out, passed through running water, and hung up to dry. This quantity is sufficient for eight yards of stuff. The flax and hemp fibers, in absorbing the tannin, are at the same time better fitted to resist wear. This recipe is useful to millers who sack flour.

RECENT INVENTIONS.

Improved Car Coupling.

This invention, although applicable as a coupling for railroad cars generally, will be found particularly adapted to freight cars, and, taken as a whole, forms a strong, reliable pin-and-link coupling, which may either be operated automatically or by hand from opposite sides of the car, or from the top of it, and avoids all risk of accident to trainmen. It may be readily applied to the drawheads in common use with the ordinary form of coupling link, and provides for uncoupling standing cars which are not required to be immediately separated, and holds the link in position in one drawhead and the coupling pin raised in an adjacent drawhead, ready for coupling at any time that may be required by merely dropping the raised pin. The pin is operated by means of the lever, which can be moved by a person at the side or top of the car. The pin is retained in an elevated position by a pivoted bar which is pushed back as the link enters the drawhead, thus permitting the pin to drop through the link. The same pivoted bar also holds the link in position to be engaged by the drawhead of the adjacent car. The coupling is also provided with a device for holding the lever and pin in an elevated position, independently of the pivoted bar. This is to permit the cars to be uncoupled when desirable, without separating them. This invention has been patented by Mr. E. D. Cain, of Winthrop, Missouri.

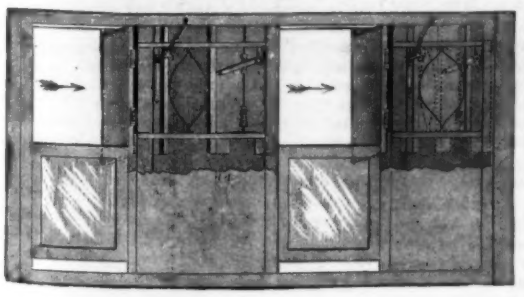


Improved Injector.

The engraving shows a steam injector which will force a solid stream of water under any pressure of steam. The body of the injector has a removable cap at its upper end to facilitate cleaning. The steam supply pipe extends through the top and connects with the lifting tube, and also with the inclined forcing tube. Water supply pipes communicate with the water chamber of the lifting tube. It will be seen that this injector is double. The vertical one lifts the water and the inclined one forces it into the boiler. Both tubes are supplied with suitable regulating and waste valves. All of the parts of this apparatus are accessible. It will deliver either hot or cold water, and works equally well whether hot or cold. We are informed that it is giving excellent satisfaction wherever it is used. This invention has been patented by Mr. Orson H. Wheeler, of Charlesworth, Mich.

Car Window Deflector.

A car window deflector to prevent dust and cinders from entering the car and for keeping up a circulation of air in the same has been patented by Mr. Henry B. Mears, of 1,429 Walnut Street, Philadelphia, Pa. The deflector consists of two sashes, one of which is attached rigidly to slide bars in such a manner that it may be slid backward and forward in the space in the side of the car. The other sash is attached to this rigid sash by spring hinges. The sashes are pressed out of the opening or space inside of the car by an elliptic spring attached to the back of the sash, and which liberates the hinged sash so that it will be swung outward to the extent permitted by the coil springs upon which it is hinged. Strips are provided which retain the deflectors in their outward position, and a stop block is likewise attached to the sill, which limits the movement of the blind and closes the space between it and the sill. For moving the deflectors inward and retaining them to the angle required, levers are provided which are operated from the interior of the car by a key. The deflectors are arranged on both sides of the windows, but only those deflectors are brought into use which are located toward the head of the train, the other deflectors remaining in the recess provided for them till the direction of the train is changed, when they come into use and the others are shut back into the recess.



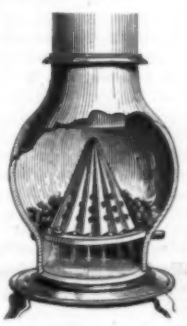
The accompanying engraving represents two windows of a passenger car, showing the deflecting devices applied. The inventor claims that by the use of his deflectors the traveling public are not only rendered more comfortable, but that it is a great saving to railroad companies, as they preserve the upholstering of the cars from cinders and dust.

Combined Cradle and Seesaw.

This is a combined cradle and seesaw, in which side rockers are used that make the undulating motion in line with the body, so that when using the device as a cradle the tossing of the body and the turning of the head of the child from side to side are avoided. The chairs or seats are adjustable. Springs are used to ease the motion, and a pulley and cord are employed to work the teeter. When the device is used as a see saw the seats are separated, as in the engraving; but when it is used as a cradle, the two seats are fastened together. By adjusting the seats at different distances a light child and a heavy one may balance each other. The cradle is provided with a treadle, which enables it to be operated by foot. This useful invention has been patented by Mr. J. Wayley Hill, of Cairo, Ill.

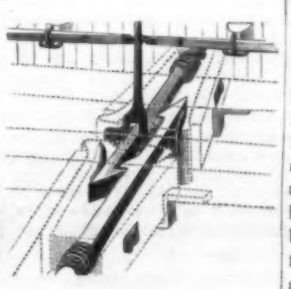
Improvement in Heating Stoves.

This a hollow side perforated cone, used to admit air laterally to the center of fire and into the combustion chamber above the fuel, so that a more perfect combustion may take place in all parts of the fire. The air which is admitted is so warmed by its contact with the inner surface of the cone that it more readily supports combustion, and but little is carried up by the draught before its oxygen has been utilized. This device economizes fuel, and increases the efficiency of the stove to which it is applied. It is very simple and inexpensive, and is applicable to stoves and furnaces of various kinds. A patent has been issued to Mr. John Kilshaw, of St. Paul, Minn., for this invention.



Improved Car Coupling.

To the under side of the cars are secured the diverging timbers, between which are held the hollow tapering bell-mouthed castings, which constitute the drawheads of the cars. These drawheads have vertical movement at their outer ends between the timbers, so that the hooked connecting bars will enter the drawheads when the cars are brought together for coupling, whether the cars are of the same height or not; and for this purpose the drawheads are cast with trunnions, and the timbers have recesses which receive the trunnions. Springs hold the outer ends of the drawheads elevated against the bottom edge of the cars, as illustrated, but permit the drawheads to be moved downward. Buffer springs are placed in recesses, against which the trunnions come when the cars are in motion. The coupling bars are each formed with two hooks, which are adapted to engage with each other for connecting the cars, and they reach back through the drawheads, and are provided at their rear ends, outside of the drawheads, with coiled springs which furnish a yielding draw. Flat springs are secured in the throats of the drawheads, for causing the connecting bars of the opposing cars, as the cars are backed together for coupling, to engage each other on entering the opposing drawheads, and to keep the hooks engaged with each other until the bars are forced apart for uncoupling. The means for forcing the connecting bars apart for uncoupling consists of a vertically movable bar having a slot through which the connecting bar of the car passes to hold it in place. This invention has been patented by Mr. Wanton C. Barber, of Villisco, Iowa.



Formation of the Solar System.

At a recent meeting of the London Physical Society, Mr. Braham gave an experimental demonstration of the vorticel theory of the formation of the solar system by rotating a drop of castor oil and chloroform in water until it threw off other drops as planets.

Electrical Units of Measurement.

Several correspondents of the *Electrical Review* have dealt with the vexed question of the "unit" of measurement for the general supply of electromotive force, and have endeavored to translate the technical expressions in use among electricians into equivalents comparable with the ordinary measurement of gas. Mr. Moulton, F.R.S., has proposed that the charge for domestic supply shall be based on the consumption of "1,000 watts for one hour." It appears, however, that a "watt" is not a quantity at all, but is simply a rate of doing electrical work. Another writer says that the usual methods of measurement are something analogous to calling "a cubic foot of gas at normal pressure the amount which will run through a certain pipe in twelve minutes at the rate of 5 cubic feet an hour." He thinks a new term, the "vomb," would be euphonious and impressive for an electrical unit. In this way a "megvomb" and "megwatt" are brought to mean the same thing, and are somehow shown to be equivalent in incandescent lights to about 30 cubic feet of 15 candle gas, or with arc lights to about 100 cubic feet of gas. It is confessed that there is a chance of great confusion among the electrical units. It would appear, from these and similar letters, that the confusion is not only coming, but has arrived. Quite lately one of the most important electric light companies was reported to have offered to supply electrical energy at the rate of 6d. per 1,000 "erg hours." We now learn from an electrician that there is no apparent way of connecting hours with "ergs." As a way of escape from impending bewilderment, we are bidden to "study the coulomb, volt, ampere, ohm, watt, and above all the vomb." It will then be just possible for the student to understand a bill for a domestic supply of electromotive force for lighting. The main fact to be gathered from this interesting discussion is that, whatever the unit may be called, its price is proposed to be equivalent to common coal gas at 8s. 9d. per 1,000 cubic feet. To this would have to be added the consumer's expenses for renewals of lamps, which are assumed to add another 1s. to the cost per 1,000 cubic feet for equivalent gas lighting.—*Journal of Gas Lighting.*

A New Test for Waste Pipes.

A Boston paper relates a discovery which may prove to be a better test for leaky waste pipes than heretofore used. The invention is accorded to a woman. Noticing an offensive odor in her parlor, she suspected a defect in the waste pipes, and sent to the agent to request that a plumber might be sent to examine them. The agent was incredulous, and refused. She tried the peppermint test. To make her proofs more convincing, the woman, after borrowing two cats from her friends, purchased some oil of valerian, and, stationing the animals in the parlor, went up stairs and poured the valerian into the basin in the same way that the peppermint had been previously applied, and then descended to watch the result. Cats are extremely fond of the odor of valerian, and it was not long before both of them began to sniff the air, and move toward the door of a closet through which the waste pipe ran. The door was opened for them, and they immediately sprang upon a certain shelf, where they remained purring with satisfaction. A third time the woman went to the agent, who, though still unbelieving, consented to send a plumber to make further investigations, and on cutting away the plastering so as to expose the pipe, a joint was found completely separated at the place where the cats had indicated.

Slates Bad for the Eyes.

Professor H. Cohn, of Breslau, believes that the use of slates by school children tends to produce short-sightedness; and would substitute either pen and ink or an artificial white slate with black pencil, manufactured in Pilsen, and already introduced into a few German schools. In 1878 Horner found (*Vierteljahrschrift offentl. Gesundheitspflege*, x, 4) that B and E could be read, if black on white ground, 496 cm.; if white on black, 421 cm.; and if gray on black, 330 cm.; and ascribed the greater difficulty with white letters to irradiation. The reflection of light from the surface of slates is, it is said, enough alone to cause their disuse. The school board of Zurich has forbidden the use of the slate after the first term (primary year), and many teachers and oculists advocate the substitution of white-boards for blackboards. The noise of slates; dirty habits formed by erasures; bad positions favored by reading the less legible script; a heavy hand; and the habit of twisting, learned with a pencil, and to be unlearned with a pen—these, it is said, are obviated by the use of pen and ink at the outset. The obvious objections are, that children can occupy themselves better with slates, and from pencil to pen is from the easier to the harder.

Artesian Well at Denver

While the miners were sinking a blind shaft for coal in North Denver, Colorado, a stream of water was struck at a depth of 375 feet. This is the first artesian well opened in the State, although nearly $100,000 has been expended by the Government and corporations in experimental sinkings. It is proposed to systematically establish wells in the neighborhood of the accidental discovery, with a view to developing the rich lands there for horicultural purposes.

ENGINEERING INVENTIONS.

Messrs. Columbus B. Tucker, of Angerona, W. Va., and Josephus Tucker, of Coolville, O., have patented an improved car coupling, which possesses the feature of having neither springs nor levers. The parts are automatic in their action and very simple in arrangement.

Mr. Eberhardt Nicolaisen, of New York city, has patented an electric mail conveyer, the object of which is to construct an electrical railway for the conveyance of mail matter from station to station, and to provide for the automatic transfer of the cars from the main track to the side tracks of the several stations.

An improved nut locking device has been patented by Mr. George Cade, of Milan, Tenn. A fixed washer is so placed under the nut that in screwing the latter to the rail, the nut is permitted to turn readily on the bolt. When in position the nut is held fast by a tumbler, so that it cannot become loose by any jarring motion of the rail. By raising the tumbler it is possible to so disengage the washer as to permit the nut to be turned off as desired.

An improved automatic switch stand has been patented by Messrs. Oliver J. True, of Port Clinton, and Henry H. Houghton, of Elyria, O. The object of the invention is to provide for automatically replacing the tongues after they have been displaced by a train from the siding, or one coming in the same direction on the main line, so that the switch will be in proper order for the next train running in the reverse direction of the train that has displaced the tongues. The object of the invention is praiseworthy, and we hope it may be practically tested.

An improved packing, possessing flexibility, durability, and self-lubricating qualities, and designed to be applied to valve stems, stuffing boxes, etc., has been patented by Mr. William P. Woodruff, of New York city. The packing is composed of canvas or other cloth, asbestos paper, and sheet rubber, or India-rubber cloth wound in alternate sections around a core of fragmentary metal. Between the different materials used in making up the packing a thin layer of plumbago mixed with tallow is interposed to prevent the layers adhering and for rendering the packing flexible.

An improved car coupling has been patented by Mr. William T. Van Dorn, of Lincoln, Neb. The invention consists in a coupling bar having at its end a downwardly projecting catch, which engages with a bevel coupling pin located horizontally in the drawhead. The coupling bar is forced down on the pin by a pivoted bar situated in the top of the drawhead, which latter is furnished with a coil spring. The advantage claimed for this simple invention is, that the coupling bar may be readily applied to the pin and link coupling now in general use.

Mr. Benjamin Bennett, of Hyde Park, Pa., has patented an improved car brake. To the platform of the car is attached the permanent portion of a rose clutch, and the movable portion of the clutch is attached to a staff, so as to turn with it by a square or other form, but to slide freely up and down on the same. A pivoted foot lever is inserted through a slot in the fixed portion, so that by pressing the lever down with the foot the movable portion will be raised, disengaging the staff, so that the brakes will be disconnected from the wheels. When the foot is removed from the lever, the weight of the movable portion will bring it into engagement with the lower portion of the clutch, when the brake will be ready for operation.

MECHANICAL INVENTIONS.

An improved drag saw machine, in which the saw is suspended at its shank by a pendulum and has a handle attached for working it, has been patented by Mr. John C. Wygant, of Ontville, O. The invention further consists in the manner of adjusting and controlling the pendulum.

A novel combination tool has been patented by Mr. Harry U. Kistner, of Bordentown, N. J. This implement is one of those useful articles which almost every person has occasion to use very often. The same handle accommodates a number of tools, among which are a cork screw, gimlet, skate sharpener, etc.

A means of communication between a railroad train and any station on the line or any telegraph office within the circuit through an electric wire, has recently been patented by Mr. W. T. Waters, of Atlanta, Ga. An insulated conductor is suspended along the side of the road, on which a conductor on rollers travels with the train. Connection between the rolling conductor and one of the cars by a rod propels the former. The improvement pertains particularly to the construction of the movable roller.

A machine for scrubbing floors is the recent invention of Mr. Patrick Gallagher, of New York city. A barrel-shaped tank for holding the soapsuds is mounted on rollers, and just outside this cylindrical tank and attached to it is run a vertical shaft, to the lower end of which are attached the scrubbing brushes. These brushes are made to revolve by turning a crank which is geared to the shaft. This machine both scrubs and dries the floor, and will be found specially useful for polishing waxed floors, and cleaning large halls, piazzas, etc.

An improved street sweeping machine has been patented by Mr. Patrick Ryan, of New York city. The invention relates to that class of street sweeping machines which carry the sweepings into a receiver forming part of the machine, from which the dirt is dumped at intervals into piles. The brush is supported in a frame and connected with the axle of the vehicle by a chain and cog wheel, by means of which it is rotated, and the dirt deposited in the lower portion of the dust pan or apron, from whence it will be raised into the dirt receiver by means of the buckets provided for this purpose.

A novel revolving hat blocking table has been patented by Mr. Mari A. Cuming, of Brooklyn, N. Y., which consists of a revolving steam box or vessel adapted to carry the hat dies or moulds, also in a stuffing box for preventing the escape of steam. Clips for holding the stuffing box on the supporting table are provided, and the same revolve on its longitudinal axis. The invention further consists in an enlargement formed in the lower part of the steam supply pipe for collecting the water of condensation.

An electric device for regulating the ventilation and heat of incubators is the subject of a patent recently granted to Mr. Frank Rosebrook, of Elmira, N. Y. By the use of the electric appliance of Mr. Rosebrook it is claimed that the destruction of eggs will be greatly diminished, and the hatching process accelerated. The invention of the incubator has proved a great boon to the hen; she has been relieved by it of a monotonous portion of her life, and now comes in an electric contrivance which, by mechanical means, still further facilitates the hatching process.

A novel device in the form of an auxiliary rifle barrel for guns has been patented by Mr. Harry T. Martin, of Fort Robinson, Neb. The invention relates to a bushing for the breech of the rifle barrel, said bushing extending a short distance along the barrel beyond the cartridge chamber, and having a flange at the base corresponding to the flange of the large cartridge, by which means a smaller cartridge may be used than the one for which the rifle was originally intended, and thus much expense saved in case the rifle is to be used in gallery practice. A spring or springs to secure the bushing in the barrel is also provided, and a shell extractor contrived to be worked by the rifle shell extractor.

An improved screen cleaning device has been patented by Mr. Thomas Holman, of Salem, Ore. A frame of any approved form is furnished with a reciprocating inclined screen sliding on ways. This screen is operated by a spur wheel that gears with a pinion actuating a crank, which crank is connected with the screen by a rod, or it may be reciprocated by any other suitable mechanism. A roller rubbing frame, arranged beneath the screen, may be stationary or may be reciprocated in direction of the screen by a shaft connecting it with a crank wheel. The sifting screen is cleaned by its contact with the rubbers, which are mounted transversely with the screen and in such relation thereto as to clean the screen without injuring it. These rubbers are in the form of rollers, and are alternately fixed and rotatable.

An improved rice beating machine, the object of which is to facilitate the treatment of rice, to remove the inner skin, and to clean and polish the kernel after the rice has been hulled has been patented by Mr. James Decker, of Surrency, Ga. To the central bar of the frame of the machine is journaled a crank shaft, to the middle portion of which is attached a pulley to receive a driving belt. To the cranks of the shaft are pivoted the upper ends of pitmen, the lower extremities being pivoted to bars which slide up and down along the central brace of the frame, and to which bars at their lower ends the beaters or pestles are attached. The mortar is cylindrical, and is pivoted at its center in such a way as to be revolved by means of worm wheels which are actuated by a rotating shaft. By this arrangement all the rice in the mortar is brought in contact with the pestle.

A new machine for beveling the edges of circular, oval, or similar shaped mirrors or plain glass with curved or partly curved edges, has been patented by Mr. Thomas F. Gilroy, of New York city. The invention consists in an abrading wheel mounted rigidly on a vertical shaft, so as to rotate in a horizontal plane. Its lower end rests upon a pivoted lever, the latter of which is provided with an adjustable balancing weight for regulating the pressure of the wheel on the glass. The abrading wheel is set in action by a belt which passes around a series of pulleys located on the supporting shaft. A sponge is fastened on a rod so as to press against the periphery of the abrading wheel, to prevent the water from being thrown off by centrifugal force. The glass to be beveled is held between clasping plates, and is pressed upon the revolving stone, the pressure and degree of bevel being regulated by a feeding screw.

An improved animal trap has been patented by Mr. Talton B. Turley, of La Mine, Mo. It consists in a cylindrical or other shaped vessel resting upon a tank filled with water, and provided with a tilting pivoted platform. At the further end of this platform, upon a sliding hook arranged above the platform, is fastened the bait. The bait hook is made to slide when the bait is pulled upon by the animal, as he sinks downward with the swinging platform, in order that he may not be startled and turn back before it is too late. A small tank of water is likewise placed near the platform as an additional bait, and for some kinds of animals a pin is inserted under the platform, which holds it to be withdrawn by the trapper when the animal is in a proper position to be caught. A spring is arranged above the platform which prevents it from turning too far on its pivot, and which throws it back into place when the animal has been precipitated into the tank below.

AGRICULTURAL INVENTIONS.

Messrs. Richard E. Caviness and George McCormick, of Beckwith, Iowa, have patented an improved trip wire for check row corn planters. The invention relates to a trip wire for check row corn planters, constructed with eyes at regular intervals, and having rings secured in them. The rings are grooved to prevent them from slipping in the eyes of the trip wire.

Mr. Arthur W. Cash, of Decatur, Ill., is the patentee of a new and ingenious check rower for corn planters, in which he provides for lengthening the stroke of the seed slide, and obtains a positive and direct action from the reel shaft to the seed slide. Owing to the simplicity of the arrangement of the several parts of the machine, it is not liable to get out of working order, and it possesses many advantages not found in other check rowers.

An improved straw stacking machine has been patented by Messrs. Henry S. Stone, of Orange, and James M. F. Shepler, of Lyon's Station, Ind. At one end of the thrashing machine is attached a short elevator or carrier which takes the straw from the thrasher, carrying it to the elevator of the thrasher. This elevator may be raised by a windlass attachment to any elevation that may be required, and further it may be swung to the right or left, when it is desired to distribute the straw in forming the stack.

Mr. William Sinclair Craig, of Courtney, Texas, is the inventor of a new cotton chopper which consists of two hoes secured to a pair of bars, which are separated and held in position by a spring. These pivoted bars are attached to the axle of the sulky, and are slotted so that they slide up and down to conform to the unevenness of the ground. The number of parts comprising the machine are very few and the arrangement of them very simple.

An improved straw stacker has been patented by Messrs. Lewis W. Berger, Edward A. Peters and Oliver P. Chaney, of Groveport, O. The invention consists in an elevator frame mounted upon a four wheeled vehicle, and so constructed that it may be raised to any inclination and held in any position. The machine is designed with the object of receiving the straw as it comes from the thrashing machine and forming it into a stack near by.

An improvement designed to promote the strength of the individual teeth of harrows has been patented by Mr. John L. McKay, of Franklin, Tenn. This invention consists in harrow teeth constructed in an approximately V-shaped form, one prong being perpendicular and the other arm being inclined. The forward arms of one row of teeth are connected to one beam of the harrow, and the rear arms of the same row connected to a second beam, and so on to the third, so that the teeth of one row alternate with the teeth of the adjacent row.

A novel bundle carrier for harvesters has been patented by Mr. James W. Reid, of Union City, Mich. The invention consists in a bundle carrier for harvesters, constructed with gear wheels connected with the harvester mechanism and carrying a swinging shaft having curved arms to carry the bundles, and provided at its inner end with a trip arm to turn the swinging shaft, to raise its arms to receive a bundle, and to depress the said arms to discharge the bundle. To the rear part of the harvester frame is hinged a table to receive the bundles singly, and drop them in groups at the rear of the harvester. To the end of the shaft that drives the carrier is attached a curved arm to push the bundles forward as they are deposited upon the receiving table, and make room for the bundles following.

An improved tobacco planter has been patented by Mr. Sidney S. Neblett, of Whittle's Mills, Va. The invention consists of a frame with a crosspiece at the top, provided with a central opening through which passes a spring-actuated perforator, designed to open a hole in the ground for the admission of the plant. At the lower extremity of another movable bar is pivoted a funnel-shaped device or holder, in which the plant is inserted. This holder is then slid down until the plant is deposited in the opening in the ground. The opening is then filled with earth by means of a scraper which is located at the extremity of a third rod or handled bar. The device is of a simple construction, and obviates the necessity of the operator stooping when setting out the plant.

MISCELLANEOUS INVENTIONS.

A novel toy pistol, adapted to explode caps and project marbles through the air by a compressed coiled spring in the barrel, has been patented by Mr. Otto C. Butterweck, of St. Louis, Mo.

An improved coffee or tea pot has been patented by Mr. Patrick H. O'Hara, of Philadelphia, Pa. The object of the invention is to extract from tea, coffee, or other material all their essential strength, retaining at the same time all the fragrance and aroma.

An improved earring fastener has been patented by Mr. George Krementz, of Newark, N. J., the object of which is to facilitate the opening, closing, and rendering secure the fastening.

Mr. William E. Goodenough, of Newark, N. J., has received a patent for an extension photograph frame, the object of which is to provide frames for photographs and other pictures, so constructed that they can be adjusted to receive pictures of different sizes.

An improved hand truck has been patented by Mr. James H. Strugnell, of Toronto, Ontario, Canada. The invention consists in cleats attached to the under sides of the side bars of the truck, and of a rope or belt which is attached to the cleats and is used to hold the load on the truck.

Mr. W. H. Murphy, of Brenham, Texas, has recently patented a shaker or knodler for the mixing of drinks or liquids. In form it is similar to those used in most bar rooms, but it has the advantage of a strainer attached to the vessel, through which the liquid is strained after shaking.

Mr. Marion E. Porter, of Leon, Iowa, has patented a cooking attachment for oil stoves, the object of which is to provide a new attachment for oil stoves, whereby an increased quantity of food can be cooked than heretofore on an oil stove. An ingeniously arranged transmitter of heat is provided, which diffuses the heated air evenly throughout the attachment on which the articles to be cooked are placed.

Mr. William J. Morand, of Passaic, N. J., has invented a machine for rolling buttons on whips, the object of which is to facilitate the rolling and finishing of the buttons on whips. The machine has two parallel rollers provided with a driving mechanism, and a short roller pivoted to a swinging lever, whereby the buttons are rolled and finished while the whips and buttons are revolved by the rollers.

Mr. Benjamin N. Shelley, of Anderson, Ind., is the patentee of a new wheel intended for any kind of road vehicles. On the main axle a steel sleeve is placed on the spindle of the axle, which receives the entire wear of the wheel boxes. These sleeves are made of the hardest steel, and will last probably as long as any vehicle body, but should they become worn they can be readily removed and replaced by others. The spindle of the axle is tapering, and is provided with a thread at its front end forming a close, oil tight joint, which facilitates the lubrication of the axle.

An improved harness loop has been patented by Mr. Henry A. Pott, of Cape Girardeau, Mo. The invention consists in a double loop for a harness, having an intermediate, a top, and a bottom plate, connected together by the side plates, and having the top and bottom plates located out of the plane of the rivet, whereby the strain upon the strap or trace is thrown upon the center of the rivet instead of one end, and being thus equalized, there is less danger of the parts separating under strain.

Mr. Mathias Pabst, of Washington, D. C., has patented a means for preventing overflow from back water. This invention, which takes advantage of the principle of equalizing the level of the high water by means of a stand pipe; consists in making this stand pipe detachable, with its lower end adapted to be fitted into the mouth of the sewer with a water tight joint by simply telescoping into the sewer. By this means, when the water rises in the sewer from whatever cause, it simply rises in this tube to its own level without flooding the cellar, and damaging any goods that may be stored therein.

A corset of improved make has been patented by Mr. Richard V. Cable, of Poughkeepsie, N. Y. The improvements consist in providing upward extensions of the breast swells to prevent the dress falling in above the upper edge of the corset, and in the construction and attachment of skirt supporters, to prevent the waist line being unnecessarily enlarged, and at the same time the weight of the skirts is mostly thrown upon the shoulders of the wearer.

An improved sewer and drain tile for surface or subsoil drainage or sewage, which is well adapted for different localities and under varying conditions of use, has been patented by Mr. George J. M. Porter, of Princeton, Ill. The invention consists in a pipe consisting of a series of tile sections, each open at the top, and provided with a half band at one end, made integral there with; these sections being adapted to receive a cover or top tile having its ends fitting under the half bands of two adjoining lower tile sections.

Messrs. E. B. Greene and C. J. Emerson, Jr., of Westfield, Mass., have recently patented an improved metronome, or an instrument for beating time, the object being to simulate by a beater or baton the ordinary movements given by hand, so as to indicate directly the length of each note in a bar of music. The invention consists in a shaft to which is attached a beater or baton which is operated by a cylinder that is rotated by spring power. The cylinder is provided with pins on its surface similar to the arrangement of a barrel in a music box. An escapement of novel construction regulates the rotation of the cylinder.

A patent has been obtained for the manufacture of anhydrous sulphide of zinc by Mr. Thomas Macfarlane, of Acton Vale, Quebec. The invention consists in producing zinc sulphide through the intervention of the ammoniacal liquors of gas works, which consists in treating the latter with sulphide of barium, then removing the precipitated carbonate of baryta, and decomposing the ammonia liquid filtrate with a salt of zinc, so as to obtain a precipitated zinc sulphide. This is rendered anhydrous by mixing it, when dried, with a salt of ammonia, and heating the mixture in a furnace, which removes the water of the sulphide without oxidating the compound.

A novel folding desk has been patented by Mr. Magnus J. Hafgar, of Chicago, Ill. A desk is provided with two hinged or pivoted swinging end wings which have their outer surfaces or sides ornamented to represent the front of a closed desk. The desk itself, as well as the wings, is furnished with pigeon holes, compartments, drawers, etc., to receive books and papers. When the wings are swung open they will rest transversely against the ends of the desk, and there meeting will be at the front of the desk. By this arrangement the desk when folded occupies but very little space, but when open presents a very imposing front.

Mr. Charles R. Groff, of St. Paul, Minn., has recently patented a process for preparing a coffee compound intended as an article of merchandise, similar to the essence of coffee now so extensively sold by grocers. The ingredients used are coffee roasted and ground, which is boiled in water to the proportion of two quarts to one pound coffee. After the coffee has boiled sufficiently, alcohol or cologne spirits are added, after which the liquid is again boiled for a short time, when glycerine and burnt sugar are added, which complete the process of manufacture and renders the article ready for bottling. Connected with the manufacture of the coffee compound, the inventor uses a novel vessel for boiling and treating the ingredients.

An improved padlock has been patented by Mr. Thomas Donahue, of Terryville, Conn. The invention consists in a padlock, the operation of which is somewhat as follows: To release the shackle the notched key is inserted and the key turning the tumblers, the notches are brought into line beneath the pawl, so that the pawl falls in the notches. By further movement of the key the tumblers engaging the pawl carry the bolt backward, thereby releasing the shackle, which is immediately thrown upward by the spring. Upon the shackle being pushed down to its place again, the block in which it fits, and which carries the spring, is moved down into its place, and the bolt springs forward and locks the shackle. The whole is of a simple construction, while at the same time the lock is not acted upon by the weather, and cannot be readily picked.

An improved cooper's bevel, to be used in the manufacture of tubs and tanks, has been patented by Mr. John F. Lonergan, of St. Louis, Mo. The object of the invention is to furnish an instrument by which the angles in a variety of sizes may be obtained, so as to avoid the necessity of a separate instrument for each size of tub or tank. The instrument consists of two blades, one of which is termed the "base" of the instrument, and the other the "adjustable arm." The base is furnished with two parallel and longitudinal slots, and the arm is made with two similar slots. The arm is attached to the base by screws passing through the slots, and held by clamping nuts, to allow of the adjustment of the arm upon the base at right angles or in any position as may be desired.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

The Hat Holder Patent, illustrated on page 198, will be let on royalty, or a part interest sold.

Wanted —First-class metal pattern-maker. One familiar with gating and making small metal patterns. Address St. Louis Malleable Iron Co., St. Louis, Mo.

Gear Wheels for Models (list free); Experimental Work, etc. D. Gilbert & Son, 212 Chester St., Phila., Pa.

Another Victory!—In spite of all competition the contract for furnishing (7,000) seven thousand feet iron fence to inclose Woodland Avenue Cemetery, at Cleveland, O., was on March 5, 1883, awarded to Champion Iron Fence Company, Kenton, Ohio.

The Ide Automatic Cut-off Engine, designed for driving electric lights and furnishing steady, reliable power; high speed; superior construction; economy in fuel guaranteed. A. L. Ide, Springfield, Ill.

Read the *Electrical Review*, advertised in this issue.

Comfort Dinner Pails —Most convenient in use. For sale everywhere. Reardon, Ennis & Co., Troy, N. Y.

For Sale Cheap.—New and second-hand engines, boilers, pumps, pipe, etc. Address Young & Locke, 68 and 70 South Franklin Street, Titusville, Pa.

The following letter from a well known dealer in building materials will explain itself:

AKRON, O., February 24, 1883.

MR. —: In reply to your request to give you my opinion of H. W. Johns' Paints, I take pleasure in stating that I have been handling these paints for nearly eight years, keeping them on sale in all the different shades and using them in my building business, and I have no hesitancy in saying I believe them to be the cheapest and best paints in use, not excepting pure lead and oil. They are cheaper, because they will spread over more surface and cover better. I know to a certainty that two coats will cover better and last longer than three of any other paint, and it will outwear and retain its luster and color better than any other. I have tried many kinds of paint, and had concluded before using these that pure lead and oil was the only reliable paint, but after years of experience I am entirely satisfied that these paints are much better and more economical to use.

D. W. THOMAS.

Storage Electricity, $1; Dictionary Electricity, $2. All inventions described. Best out. School Electricity, N.Y.

American Fruit Drier. Free Pamphlet. See ad., p. 189.

Am. Twist Drill Co., Meredith, N. H., make Pat. Chuck Jaws, Emery Wheels, Grinders, automatic Knife Grinders.

The Chester Steel Castings Co., office 407 Library St., Philadelphia, Pa., can prove by 20,000 Crank Shafts and 15,000 Gear Wheels, now in use, the superiority of their Castings over all others. Circular and price list free.

Brass & Copper in sheets, wire & blanks. See ad. p. 190.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Diamond Engineer, J. Dickinson, 64 Nassau St., N.Y.

Tight and Slack Barrel Machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus. adv. p. 190.

For best Portable Forges and Blacksmiths' Hand Blowers, address Buffalo Forge Co., Buffalo, N. Y.

Cutters for Teeth of Gear Wheels formed entirely by machinery. The Pratt & Whitney Co. Hartford, Conn.

Catechism of the Locomotive. 625 pages, 250 engravings. Most accurate, complete, and easily understood book on the Locomotive. Price $2.50. Send for catalogue of railroad books. The Railroad Gazette, 73 B'way, N.Y.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 190.

20,000 Duc Spherical Elevator Buckets, sizes 3½ to 17 inches, constantly on hand. Telegraphic orders filled. T. F. Rowland, sole manufacturer, Brooklyn, N. Y.

First Class Engine Lathes, 20 inch swing, 8 foot bed, now ready. F. C. & A. E. Rowland, New Haven, Conn.

Scientific Books. See page 188. 100 page Catalogue free. E. & F. N. Spon, 44 Murray Street, N. Y.

Permanent Exposition.—Inventors' Institute, Cooper Union, N.Y. City. Every facility for exhibition of machinery, merchandise, and inventions. The expense is small —the advantages great. Send for particulars.

Drop Forgings. Billings & Spencer Co. See adv., p. 173.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 174.

For Mill Mach'y & Mill Furnishing, see illus. adv. p. 172.

See New American File Co.'s Advertisement, p. 174.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 172.

Steam Pumps. See adv. Smith, Vaile & Co., p. 172.

Common Sense Dry Kiln. Adapted to drying of all material where kiln, etc., drying houses are used. See p. 174.

Contracts taken to manuf. small goods in sheet or cast brass, steel, or iron. Estimates given on receipt of model. H. C. Goodrich, 66 to 72 Ogden Place, Chicago.

Lightning Screw Plates, Labor-saving Tools, p. 156.

Woodwork'g Mach'y. Rollstone Mach. Co. Adv., p. 158.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, polishing compositions, etc. Complete outfit for plating, etc. Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description.

Lists 29, 30 & 31, describing 4,000 new and 2d-hand Machines, ready for distribution. State just what machines wanted. Forsaith & Co., Manchester, N. H., & N. Y. city.

Forsaith & Co., 209 Centre St., N. Y. city, have the following new, first-class modern engine lathes ready for instant shipment: 6' x 16", $300; 6' x 18", $325; 8' x 18", $345; 9' x 18", $365; 18' x 18", $385; 8' x 20", $375; 12' x 20", $415; 8' x 22", $550; 14' x 26", $700; 16' x 26", $736. Also, of new first-class upright drills, as follows: 18", $110; 20", $150; 24", $185; 28", $315; 32", $365. One 48" radial drill, $750. With a large stock of other machine tools.

James Hamblet, Electrical Clocks. P. O. Box 1414, N.Y.

"Abbe" Bolt Forging Machines and "Palmer" Power Hammers a specialty. Forsaith & Co., Manchester, N.H.

Magic lanterns, stereopticons, cond. lenses, etc., on hand and made to order, C. Beseler, 218 Centre St., N. Y.

Railway and Machine Shop Equipment.
Send for Monthly Machinery List
to the George Place Machinery Company,
121 Chambers and 103 Reade Streets, New York.

Improved Skinner Portable Engines. Erie, Pa.

25" Lathes of the best design. G. A. Ohl & Co., East Newark, N. J.

For Power & Economy, Alcott's Turbine, Mt. Holly, N. J.

"How to Keep Boilers Clean." Book sent *free* by James F. Hotchkiss, 84 John St., New York.

Engines, 10 to 50 horse power, complete, with governor, $250 to $550. Satisfaction guaranteed. More than seven hundred in use. For circular address Heald & Morris (Drawer 127), Baldwinsville, N. Y.

Wanted.—Patented articles or machinery to make and introduce. Gaynor & Fitzgerald, New Haven, Conn.

Latest Improved Diamond Drills. Send for circular to M. C. Bullock Mfg. Co., 80 to 88 Market St., Chicago, Ill.

Water purified for all purposes, from household supplies to those of largest cities, by the improved filters manufactured by the Newark Filtering Co., 177 Commerce St., Newark, N. J.

Ice Making Machines and Machines for Cooling Breweries, etc. Pictet Artificial Ice Co. (Limited), 142 Greenwich Street. P. O. Box 3083, New York city.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works. Drinker St., Philadelphia, Pa.

Machinery for Light Manufacturing, on hand and built to order. E. E. Garvin & Co., 139 Center St., N. Y.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Supplement Catalogue.—Persons in pursuit of information on any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

Correspondents sending samples of minerals, etc., for examination, should be careful to distinctly mark or label their specimens so as to avoid error in their identification.

(1) **W. B. writes:** 1. I read that lead put in sweet oil and set in the sun would make good oil to use on a gun. After it has been in the sun a number of days a white sediment falls. What is this sediment? A. We cannot tell what the white sediment is; probably a combination of lead with some acid contained in the oil. 2. Is there any quicker way to make the oil than by the sun? A. None. 3. Is this oil poisonous if it was taken by accident? A. The lead is poisonous, but the mixture would probably be harmless. 4. Will it hurt guns in any way by using it on the works or barrel? A. No.

(2) **C. H. D. asks:** What benefit is it to have castings blued? I think it opens the iron, and the japan adheres to it. If there is any benefit derived from it, please state it through your paper. How much heat is required for japanning sewing machine work black, brown, white, green, and blue? A. The heating of iron work, or bluing as it is called, is to make the japan take evenly, and also to clear the work of any oil or grease that may remain in the corners or on the porous surface, which interferes with evenness of drying. The heat required must be suited to the kind of japans used, and must be ascertained by trial, as the same kinds and colors of japans made by different establishments will vary very much in their baking qualities. As a general rule, the best strong black requires a heat of 250°. Colored japans require from 200° to 240°, according to the nature of the pigments, oxides generally drying easier than carbonates or sulphates.

(3) **S. W. asks:** 1. What are the component parts of smoke, or of what gases is it composed; and in what proportion, both of wood and coal, and what is it that is in the smoke or passes off with it that is incombustible? If the oxygen of the air in passing through the fuel causes its combustion and is burned with it, what becomes of the nitrogen? A. The results of a perfect combustion of either wood or coal are carbon dioxide and water, but as there is generally insufficient oxygen to combine the carbon, small particles of it pass off and color the smoke. Nitrogen is inert, and has no effect on the combustion at all. 2. Is there anything that passes off from the burning fuel that is not combustible; or can everything that escapes from the fuel, or that passes out of the smokestack, be burned or utilized? A. Most combustions are imperfect, and therefore it frequently happens that vapors pass out of the chimney without being consumed. 3. Has water gas (*i.e.*, decomposed water) ever been used to any advantage in making or assist in making steam; or is there any known way of using it to be a benefit? A. Water gas is in common use for illuminating and heating purposes.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

F. G.—The sample is iron sesquioxide (limonite) containing iron sulphide (pyrites). The latter may contain gold. An assay would cost $5. A simple determination of the amount of iron would be the same.—G. L. N.—The specimen is a clay iron ore. It is composed of pyrites (iron sulphide) which has become oxidized externally by the influences to which it has been subjected.—A. B. C.—The powder has the appearance of being a micaceous mineral pulverized. We do not think that it contains sufficient alumina to be of any service as a material for fire brick.

[OFFICIAL.]

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INDEX OF INVENTIONS

FOR WHICH

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March 13, 1883,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for 25 cents. In ordering please state the number and date of the patent desired and remit to Munn & Co., 261 Broadway, corner of Warren Street, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications, not being printed, must be copied by hand.

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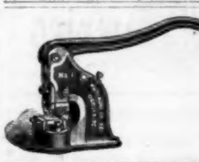
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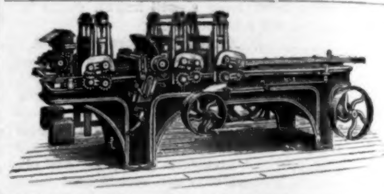
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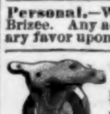
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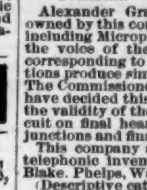
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To find what a square body which measures one inch on each side measures across the corners; to find what diameter a cylindrical piece of wood must be turned to which is to be squared, and each side of which square must measure an inch. To find a radius across corners of a hexagon or a six-sided figure, the length of a side being an inch. To draw a stud. To pencil in a cap nut; penciling for a link having the hubs on one side only. Link with hubs on both sides; pencil lines for a double eye or a knuckle joint. Double eye or knuckle joint with an offset; a connecting rod end. A rod end with a round stem. A bolt with a square under the head. Example in which the corner where the round stem meets the square under the head is sharp; a center punch giving an example in which the flat sides gradually run out upon a circle, the edges forming curves. CHAP. VIII. SCREW THREADS AND SPIRALS.—Screw threads for small bolts with the angles of the thread drawn in, and the method of doing this. 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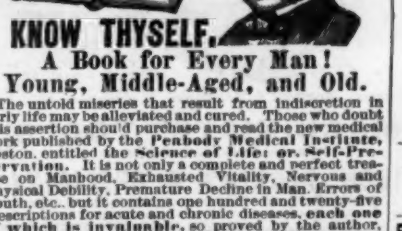

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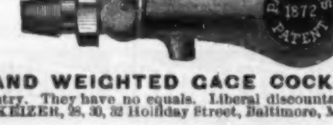

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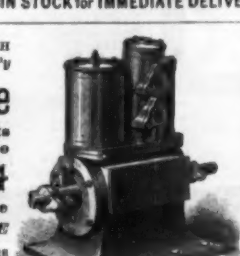

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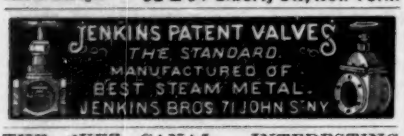

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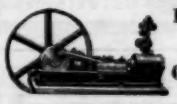

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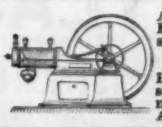

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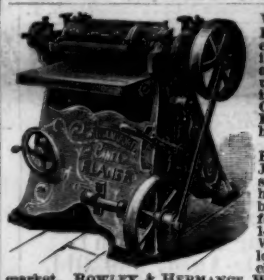

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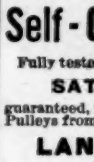

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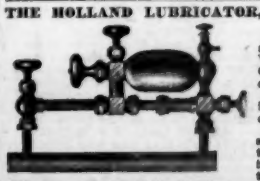

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